PEAT POLICIES AND ACTIVITES IN CANADA.
VOLUME I: HIGHLIGHTS

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EXECUTIVE SUMMARY

J. Phillip Nicholson Policy and Management Consultants Inc. (Ottawa) have produced a two volume report, Peat Policies and Activities in Canada, in response to an unsolicited proposal which identified the need for an assessment of the current status and organization of peat research and development in Canada.

The information and recommendations contained in the report are designed to assist policy makers and program coordinators in defining future directions for peat-related research and development in Canada. The report is also intended to be of use and interest to individuals and agencies in both the public and private sectors who are either actively involved in peat activities or who have an interest in peatlands and peat resources in Canada.

The results of the study are presented in two volumes, Volume I: Highlights and Volume II: Details.

Volume I: Highlights focuses on the current major themes and interests in peat research and development in Canada and abroad. More specifically, Volume I provides an introduction to peatlands which outlines the nature and extent of Canadian peatlands as well as their historical use and recent research interests. An overview of the interests, concerns and experiences of other countries involved in peatland development is also provided.

The major portion of Volume I is devoted to a national overview of current Canadian peat issues, interests and activities in the private and public sectors as well as a review of key policies, programs, legislation and coordinating activities of the federal and provincial governments which are of relevance to peat research, development and management in Canada.

Finally, Volume I provides recommendations in the areas of policies and legislation (at both the federal and provincial level); coordination and communication; research and development; international involvement; and training and education to aid in the further development and evolution of peat programs and activities in Canada.

Volume II: Details presents detailed information on the organization, objectives and nature of peat and peatland activities being carried out in the various agencies of the federal and provincial governments, as well as the private sector in Canada. It also presents the major programs, activities and research directions of seven European countries and several states in the United States. This is followed by Appendices, including a presentation of the current legislation and policies of particular relevance to peat research and development in Canada. The contents of this detailed volume form the basis upon which the highlights, conclusions and recommendations contained in Volume I: Highlights have been formulated.

RÉSUMÉ ADMINISTRATIF

La société J. Phillip Nicholson Policy Management Consultants Inc. (Ottawa) a produit un rapport en deux volumes intitulé, Peat Policies and Activities in Canada, en réponse à une proposition non sollicitée qui identifiait le besoin de faire une évaluation de l'état actuel et de l'organisation de la recherche et du développement sur la tourbe au Canada.

L'information et les recommandations contenues dans le rapport sont conçues pour aider les responsables de l'élaboration de politiques et les coordonnateurs de programmes à définir les orientations futures de la recherche et du développement reliés à la tourbe au Canada. Le rapport est également destiné à éveiller l'intérêt d'individus et d'organismes, tant dans le secteur public que privé, qui participent activement à des activités reliées à la tourbe ou qui s'intéressent aux tourbières et aux ressources provenant de la tourbe au Canada, et à leur être utile.

Les résultats de l'étude sont présentés en deux volumes, nommément: Volume I: Highlights et Volume II: Details.

Le Volume I intitulé Highlights fait le point sur les principaux thèmes et intérêts courants de la recherche et du développement dans le domaine de la tourbe au Canada et à l'étranger. Plus précisement, le Volume I renferme une introduction aux tourbières dans laquelle sont tracées les grandes lignes de la nature et l'étendue des tourbières canadiennes et de leur utilité historique ainsi que des intérêts, des préoccupations et de l'expérience d'autres pays engagés dans le développement des tourbières.

La plus grande partie du Volume I est consacrée à une vue d'ensemble, à l'échelle nationale, portant sur les questions, les activités et les intérêts canadiens courants au chapitre de la tourbe dans les secteurs public et privé et passe en revue les politiques, les programmes, les lois et les activités coordonnatrices clés des gouvernements fédéral et provinciaux ayant rapport avec la recherche, le développement et la gestion de la tourbe au Canada.

Finalement, le Volume I contient des recommandations au chapitre des politiques et de la législation (à la fois aux niveaux fédéral et provincial); de la coordination et des communications; de la recherche et du développement; de la participation internationale; et de la formation et de l'éducation, lesquelles visent à contribuer au développement futur et à l'évolution des activités et des programmes reliés à la tourbe mis en oeuvre au Canada.

Le Volume II intitulé Details présente des informations détaillées sur l'organisation, les objectifs et la nature des activités ayant rapport à la tourbe et aux tourbières qui sont réalisées au sein des divers organismes des gouvernements fédéral et provinciaux et du secteur privé au Canada. Il décrit en outre les principaux programmes et les principales activités et orientations de la recherche dans sept pays européens et dans plusieurs états américains. Viennent ensuite les annexes, ainsi qu'une présentation sur la législation et les politiques courantes se rapportant particulièrement à la recherche et au développement reliés à la tourbe au Canada. Le contenu de ce volume détaillé constitue la base sur laquelle sont fondés les conclusions, les recommandations et les faits saillants contenus dans le Volume I: Highlights.

I THE REPORT

A. Purpose and Use

This report presents the observations, conclusions and recommendations of a study which has been prepared for the Government of Canada Peat for Energy and Chemicals Program, which is managed by the National Research Council. The study was undertaken by the firm J. Phillip Nicholson Policy & Management Consultants Inc. (Ottawa), and was initiated in response to an unsolicited proposal through the Unsolicited Proposal Program of Supply and Services Canada. The project proposal identified the need for an assessment of the current status and organization of peat research and development (R&D) in Canada.

The study has been directed toward all resource sectors in which peat or peatlands have a role, and has concentrated in particular on the following:

- areas of concern and interest in relation to peat resources and peat research and development
- organization and coordination of peat-related R&D activities
- policies and legislation of particular relevance to peat R&D

The report is intended to be of use and interest to individuals and agencies in both the public and private sectors who are either actively involved in peat activities or who have an interest in peatlands and peat resources in Canada. The information and recommendations contained in the report are designed to assist policy makers and program coordinators in defining future directions for peat-related research and development in Canada.

B. Methodology

The project was carried out from January to December, 1984. During this time, six months were devoted to collecting the information on which the observations, conclusions and recommendations of this report are based. This information was collected through:

- bibliographical and literature research, including Canadian and international sources

- a legal assessment of the legislation pertaining to peat development in Canada

- extensive personal interviews and/or written communication with over 100 individuals in federal and provincial government agencies, private industry, universities and private special interest groups and organizations in Canada and the United States

- personal interviews with more than 30 individuals in government and private organizations in Ireland, England, Scotland, Finland, Sweden, the Netherlands, West Germany and the United States

Information requirements were further supplemented by attendance at the International Peat Symposium in Dublin, Ireland (June, 1984) and through the contributions of associates in London, England. In a further effort to reach as many potential contributors as possible, the project was publicized through an article in the Environment Canada Lands Directorate newsletter LAND/TERRE, Vol. 5, No. 1, 1984 (edited by Nicholson Consultants). Responses to this article from more than a dozen different organizations were incorporated in the report.

In preparing this final report, which includes conclusions and recommendations for future R&D policies and programs, the consultants have also drawn on their extensive experience in environmental and resource-management fields, as well as policy and program development for more than 30 different federal departments and agencies over the past twelve years.

C. Contents

The results of the study are presented in two volumes:

Peat Policies and Activities in Canada
- Volume I: Highlights
- Volume II: Details

VOLUME I: HIGHLIGHTS, focuses on the current major themes and interests in peat research and development in Canada and abroad, and presents a series of recommendations intended to aid in the further development and evolution of peat programs and activities in Canada.

The contents of Volume I are organized as follows:

- An Introduction to Peatlands, including:
    - a brief definition of peatlands
    - a general discussion of the various research interests in peat and peatlands, and the potential and actual uses of peat resources
    - the nature and extent of peatlands in Canada
    - a brief survey of the history of peatland use and past and recent research interests in Canada
- the Status of Peat Research and Development in Canada, including:
    - a national overview of peat issues, interests and activities prevalent in Canada today
    - a review of key policies, programs, legislation and coordinating activities of the federal and provincial governments which are of relevance to peat research, development and management in Canada

- the International Experience in Peat Research and Development, including:
    - an overview of the interests, concerns and experiences of other countries involved in peatland development
- Issues, Concerns and Recommendations including:
    - a thematic summary of issues and concerns in peat/peatland research, development and management within the jurisdictions of the federal government, the provincial governments and the private sector
    - recommendations for the direction, organization, and coordination of future initiatives in Canada

VOLUME II: DETAILS presents detailed information on the organization, objectives and nature of peat and peatland activities being carried out in the various agencies of the federal and provincial governments, and the private sector in Canada. It also presents the major programs, activities and research directions of seven European countries and several states in the United States. This is followed by Appendices, including a presentation of the current legislation and policies of particular relevance to peat research and development in Canada. The contents of this detailed volume form the basis upon which the highlights, conclusions and recommendations contained in VOLUME I: HIGHLIGHTS have been formulated.

II AN INTRODUCTION TO PEATLANDS: ENVIRONMENT AND RESOURCE

A. Definition

'Peatland' is a general term used to describe a number of wetland types which are distinguished from other wetlands by the characteristic peat deposit. Peatlands are known by many names. In Canada, the most common terms used are muskeg (to describe the vast expanses of peatland in northern regions), bog and fen. Many European terms are also familiar to Canadians. Amongst these are mire and myr (commonly used in England and Sweden):, moor (as in Hoch-, Nieder-, and Uebergangsmoor) in Germany, and fehn and veen (in Holland). Likewise, the English term peat is interchangeable with turf, torf, torv and tourbière.

By whatever name it may be called, or wherever it occurs, a peatland can be identified as either an environment or as a resource; that is, as an ecological system or as a geological unit. In fact, it is both. A peatland is a living wetland community supported by an underlying deposit of humified plant material - peat. This peat deposit is a carbon resource - essentially a very young coal - which requires only the upheaval and subsequent burial that leads to carbonization under pressure. The peat deposit is also considered to be a soil body - an organic soil - and therefore constitutes a soil resource.

When treating peat as a resource, a distinction must be made between a renewable and non-renewable resource. When used as a raw material, peat is strictly a non-renewable resource. The only true renewable uses of peatlands are those which do not disturb the natural condition of the site. Although forestry and agriculture are themselves considered to be renewable resource uses, the use of a peatland for these purposes is non-renewable since it requires drainage and intensive management. Due to the resulting aeration of the soil following drainage, mineralization of the peat deposit begins and the peat is slowly depleted. This is further aggravated by some of the intensive management techniques applied to these soils. Thus, the life of the peat resource is limited for these otherwise renewable uses (although the time may in some cases be measured in centuries rather than decades.)

B. Interests and Potential Uses

Whether viewed and managed as a renewable or non-renewable resource, peatlands offer the potential for a wide variety of uses. In some cases these different uses may be competing or conflicting; in other cases, through proper management, they may complement one another. These different uses also require different management techniques and planning to determine the most appropriate use of the site. With competing interests, some degree of coordination amongst potential users is required.

Peatland uses may be divided into two broad categories:

i) in-situ uses, i.e. the use of the peatland itself, in either its unaltered state (e.g. as an ecological reserve and wildlife habitat, or as a natural water storage area), or as an area which is drained and managed (e.g. for forestry and agriculture); and

ii) extractive uses, i.e. the use of peat as a raw material, (e.g. the use of peat moss in the horticultural industry) or the use of well-humified peat (e.g. as a solid fuel or for applications in the chemical industry).

In theory, the development strategies associated with these uses may be applied independently or combined in a multiple-use approach. For example, a peatland might first be developed and managed as a source of raw material and later reclaimed for use in agriculture or forestry. The area could even be managed as a wildlife habitat. There is also the potential to carry out extractive and in-situ uses concurrently. In-situ uses might be applied in buffer zones at the periphery of a developed site, or they may be used to reclaim one portion of a peat bog before another area is developed. This approach may help to reduce the impact of development on the surrounding environment.

The multiple-nature/multiple-use characteristic of peatlands has attracted the interest and involvement of researchers and developers from very diverse backgrounds. In fact, the composition of this group is perhaps as interesting and complex as peatlands are themselves. For example, a single peatland may be a source of fascination for researchers in such pure and applied scientific disciplines as botany, wetland ecology, paleoecology & palynology, hydrology, soil science, quaternary geology, forestry, agriculture, land resource management & environmental studies, chemical engineering, materials science, combustion technology, organic chemistry. This list is by no means complete, but indicates those disciplines where peat-researchers are most commonly found. Similarly, a single peatland may be a source of raw material and employment for a number of directly or indirectly-related industries, including the horticultural peat moss industry, fuel peat industry and industrial chemicals industry; forestry; agriculture; recreation and even a specialized health-related industry - balneology.

The same multiple-nature/multiple-use characteristic of peatlands which makes the topic so attractive for such a varied group has also kept peatlands on the periphery of the various disciplines and agencies responsible for managing or directing their study and use. This has arisen largely because peatlands cannot be defined under one all-encompassing academic discipline, nor do they fall within one main area of policy jurisdiction. Thus, it has become apparent that if peatlands are to be used as a resource, some coordination of the numerous potential uses and interests is required to ensure that the management is carried out responsibly, and with a proper balancing of interests.

C. The Extent and Nature of Peatlands in Canada

The precise extent of peatlands in Canada is not known, but based on currently available surveys it is estimated that the total area of wetlands (including peatlands) in Canada is about 170 million hectares (ha), representing 18 percent of the country's land surface. Peatlands are by far the most common of these wetlands.[1] (It is believed by some experts that 90 percent of all wetlands are peatlands. If this is so, Canada's peatlands could cover approximately 150 million ha, or 16 percent of the land surface.) This enormous area constitutes the second largest reserves of peat in the world, next only to the Soviet Union.

The distribution of peatlands is shown in Figure 1: Major Peatlands of Canada.[2] It can be seen that important concentrations occur in practically every region of the country with the exception of the arctic areas. By far the most extensive concentrations occur in the Hudson Bay lowlands and in northern Alberta. However, contrary to the popular notion that peatlands are predominantly a northern phenomena, the map shows that some major concentrations of 25 percent peatland coverage or greater (i.e. 25 percent of area in region is covered by peatlands) are found in southern Canada in the populated areas of the country. Of particular interest are those areas found in central Alberta, central and southeastern Saskatchewan, central and southern Manitoba, northern Ontario, (particularly the Lake of the Woods region and the Clay Belt), central and southwestern Ontario, northeastern New Brunswick, southeastern Nova Scotia and southern Newfoundland. In addition, areas of lower but nonetheless significant concentration of wetlands (five to 25 percent of total land surface) not shown on the map are found in southwestern British Columbia, the Great Lakes and Saint Lawrence lowlands in both Ontario and Quebec, central New Brunswick, eastern Nova Scotia and throughout Newfoundland. It is in these southern, more accessible and populated regions, where interest in peatland development will be most important and where, in some cases, development is already underway.

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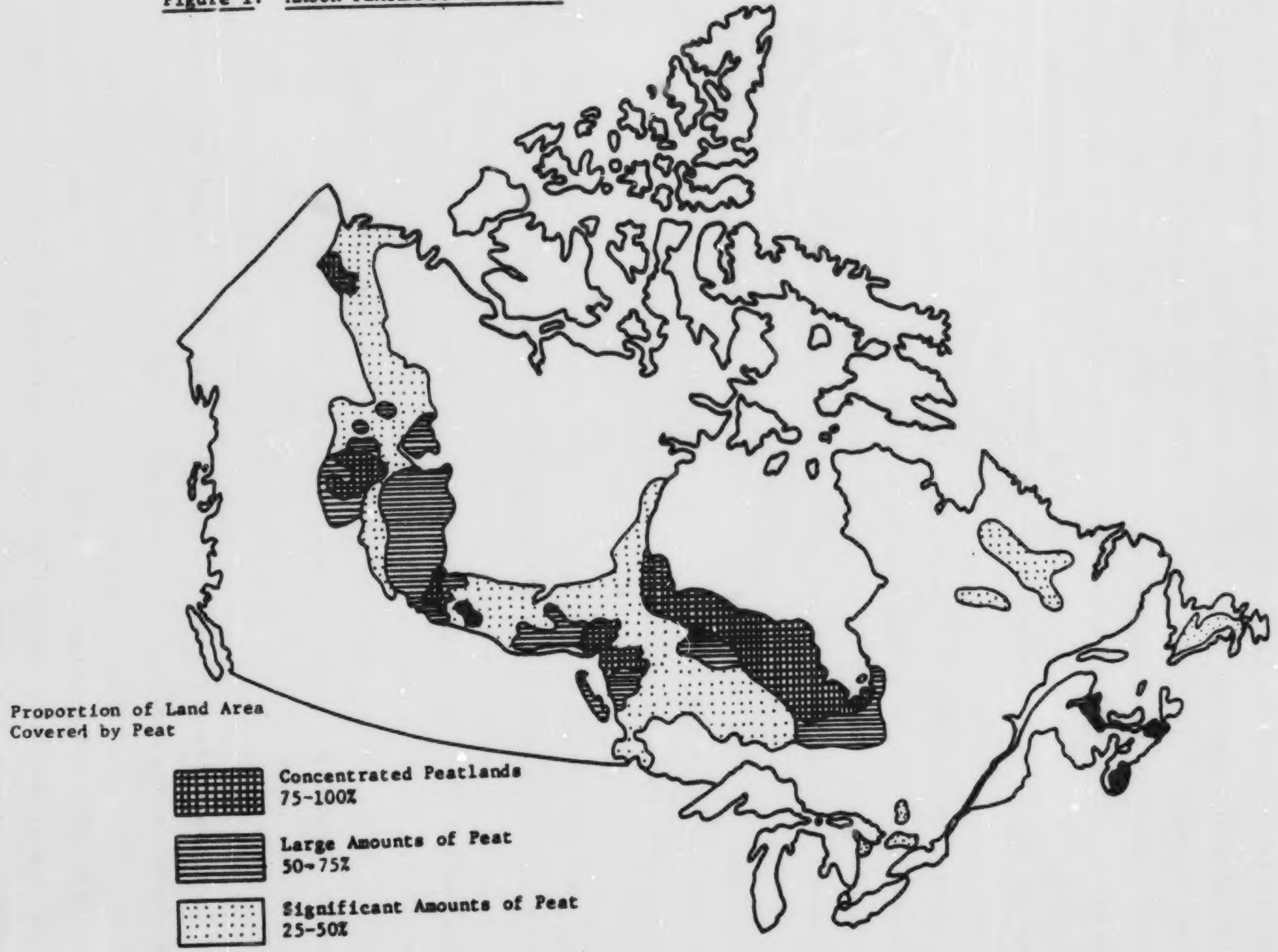
[1] IEC BEAK Consultants Ltd., Fish and Wildlife Use of Peatlands in Canada (Ottawa: National Research Council, 1983) p. 1.

[2] Ibid., Figure 2

Figure 1: MAJOR PEATLANDS OF CANADA


Proportion of Land Area Covered by Peat
Concentrated Peatlands 75-100%
Large Amounts of Peat 50-75%
Significant Amounts of Peat 25-50%

Canada is currently involved in the process of developing an adequate classification for the many distinct forms of peatlands and other wetlands found throughout the country. According to the most recent classification system, Canadian peatlands are represented by two distinct wetland types, bogs and fens. Other wetland types which are not considered to be peatlands, but which may have a shallow peatland form - that is a peat substrate - include marshes, swamps and shallow water.

In Canada, as elsewhere in the world, bogs are characterized by a peat deposit composed primarily of sphagnum moss although other mosses and some sedges are found to varying degrees in the peat. The bog surface is frequently raised in a dome or is level with the surrounding landscape. The watertable in a bog is at or near the surface and it is virtually unaffected by nutrient-rich groundwater from the surrounding mineral soil. Hence, the bog water is acidic and low in nutrients. Bogs may be treed or treeless and they are usually covered with sphagnum, feathermosses and eracaceous shrubs.

Fens are characterized by sedge peat. Fens form in depressions and the surface is even with or slightly lower than the surrounding landscape. The water table is usually at or above the surface and is influenced by both the groundwater from the surrounding mineral soil and by run-off from the surrounding drainage basin. Therefore the groundwater in a fen tends to be nutrient-rich. Fens are characterized by a vegetation cover of sedges, grasses, reeds and brown mosses with some shrub cover and occasionally a scanty tree layer.

The Canadian wetland classification identifies 19 different bog forms and 14 fen forms in the country. Surface morphology (e.g. raised, flat, depressed, pattern features, ridges, hollows, channels, etc.) is the major defining characteristic influencing the form of bog or fen. Some examples include palsa bogs, blanket bogs, slope bogs, northern and Atlantic ribbed fens, floating, stream and shore fens, slope fens, channel fens, etc. These peatland forms occur within a number of well-defined wetland regions in Canada.

Wetland regions are areas within which similar and characteristic wetlands develop in locations that have similar topography, hydrology, and nutrient regime. Climate (particularly temperature and precipitation) is perhaps the most important characteristic defining these wetland regions since it also controls the type of peatland which will develop. There are 27 different wetland regions in the country and peatlands are found in all of these.

D. A History of Peatland Interest in Canada

Despite their vastness and diversity, Canadian peatlands have never enjoyed the prestige nor interest afforded other natural environments in Canada and, until very recently, their resource potential has been largely overlooked. Peatlands have generally been regarded as a "last-hope" resource. With few exceptions, all other arable land, forests, and fuel resources are developed (and in some cases exhausted) in a given region before peatlands are considered valuable. This has been the case in those European countries where peat has formed a major part of the traditional resource base. It is also the case in those countries now in the position of having to explore and utilize their own, national, fuel reserves. Having an abundance of a comprehensive range of natural resources, Canada has been no different than other countries in this attitude; Canadians have either ignored peatlands or tried to get rid of them.

The enormous expanse of peatlands of the boreal and sub-arctic regions form a more-or-less continuous landscape known as muskeg. For most of Canada's history, these areas have remained essentially untouched and unnoticed. It was not until large-scale northern resource development became possible that muskeg was identified as a problem. It made transportation in the north extremely challenging. As muskeg was obviously too enormous in extent to eradicate, attention was turned to solving the problem of transporting heavy equipment across this very difficult terrain. Thus, the first serious investigations of peatlands in Canada were engineering studies - geotechnical research into the physical nature of organic terrain.

Peatlands in southern Canada have been viewed from a different perspective. Very few Canadians come into contact with peatlands on such a vast scale as those in the northern regions. For most people, peatlands encountered on a personal scale have been viewed as useless swamps or nuisance bogs. The initial southern response to peatlands, as with other wetlands, has been to drain them. Early Canadians had little patience or use for these mosquito-producing wastelands. Drained, the peatlands could be made more productive for agriculture. In more recent times, urbanization has become the competing land use for peatland areas. The growth of suburban communities, industrial developments and transportation corridors has frequently been achieved upon drained and reclaimed peatlands and other wetlands. It was through this process that, for example, southern Ontario wetlands - including peatlands - were reduced from 10 million hectares at the beginning of the 1800s to two million hectares today.

However, throughout Canada's history certain peatland regions of Canada have been recognized as a valuable resource. The rich black organic material has been used as topsoil for many years while the less-humified peat-moss has been used to add organic matter to mineral soils with poor structure. Over the past 50 years, a small but regionally important horticultural peat-moss industry developed, primarily in northeastern New Brunswick and southeastern Quebec, to satisfy this market. Since the first quarter of this century, a small number of peatland areas have been important truck farming regions in Canada. The lower St. Lawrence valley in Quebec, the Holland Marsh in southern Ontario, the peatlands in southeastern Manitoba and the Fraser River Delta of British Columbia are all highly-valued and highly-productive agricultural areas. Prior to this, and before the abundance of imported oil, Newfoundlanders living on the Avalon Peninsula at the southern tip of the island used peat as their basic fuel resource.

In spite of certain pockets of acceptance, the resource potential of peatlands in Canada remained largely unnoticed and without acknowledged value until as recently as the late 1970s. Even with the new urgency to preserve wetlands as valuable wildlife habitats, peatlands have remained in the corner reserved for the "undesirables" of wetland communities. From the viewpoint of wetland ecologists, peatlands are not as productive of wetland fauna as are the earlier botanical succession stages, such as marshes and swamps. To be of significant ecological value, peatlands must be developed or altered in some way that creates a wetland of greater diversity and productivity in terms of wildlife (particularly for waterfowl).

Peat and peatlands have always attracted a small number of interested Canadian researchers. However, in the face of competition from the mainstream concerns in such fields as forestry, agriculture and energy development, the work of this group of peat enthusiasts and specialists has not been highly visible outside its own boundaries. The contributions of these Canadian peat experts through the international peat community, are, however, highly visible.

Traditionally, those government researchers interested in peat have come from the fringes of agriculture, forestry and energy. Those involved in the study of organic soils or forest production in boreal regions or with fossil fuels such as coal and lignite have come into contact with peat. Some have, over the years, incorporated peat studies into their research programs, resulting in the development of several, ongoing internal research programs and projects devoted entirely to peat and peatlands.

Industrial activity has had very little influence in drawing attention to the resource. Only recently has there been any noticeable interaction between Canada's peat-moss industry and the scientific community. In general, industrial researchers have not perceived a demand for peat products and have therefore not seen a great need to become involved in this field. This is now beginning to change.

The provincial governments have also only recently become involved in studying peat resources. In fact, the first and only complete survey of provincial peat resources was undertaken less than 10 years ago in New Brunswick. Several other provinces are now at various stages of assessing the extent of their peatlands.

At the university level, interest in peat has been academic and highly specialized. Related research projects have included such topics as: the study of peatland plant communities with particular interest in sphagnum mosses; the morphology of peatlands, such as the evolution of such specialized forms as string- bogs in subarctic regions; investigations in palynology and the importance of peat deposits in providing a natural, archival environment.

Thus, apart from the few federal government and university research scientists pursuing very specialized interests, peat as a field of study has not until recently attracted much general Canadian interest.

Since 1981, attention has been turned toward the research and development of a new application for peat in Canada. The recent interest in developing peat within the energy sector has fostered a new level of interest in the resource which is being drawn from a broader base in both the federal and provincial governments, industry and universities. This has led to numerous projects and programs which are less academic than before, since the ultimate goal is the practical development of a commercially-viable fuel peat industry.

III STATUS OF PEAT R&D IN CANADA

A. Overview

Peat and peat-related research and development (R&D) activities in Canada encompass a wide variety of interests and include the involvement of numerous federal and provincial government agencies, private industry interests and university researchers. Among those interests currently being pursued in Canada, (primarily in government agencies) are:

- continued research in geotechnical and transportation studies
- investigation of the agricultural use of peatlands (this has recently expanded to include research not only on the conversion of virgin peatlands to agricultural lands and methods of prolonging production on organic soils, but on the agricultural potential of peatlands reclaimed following peat mining)
- increased interest in the use of forested peatlands and development of silvicultural techniques on peatlands
- development of fuel-peat mining technology and development of new products and/or uses for well-humified peat as either a fuel or as a chemical feed-stock
- evaluation of the environmental concerns arising from peatland development, and development of pollution-abatement technologies
- accurate assessment of the extent and nature of peatlands in Canada, including the development of techniques particularly suited to such inventory analysis purposes

Private industry has traditionally limited its activities to the operation of the horticultural peat moss industry. However, the recent activities of government agencies in the relatively new fuel-peat sector has prompted greater involvement from the private sector, particularly engineering, environmental and resource survey consultants in the following areas:

- site preparation and development for fuel-peat mining
- peat resource survey and mapping projects
- peat processing and product development research
- environmental studies
- market surveys

The above private-sector activities are almost exclusively carried out in close association with government-sponsored projects. The horticultural peat moss industry is also entering a period of product development and improvement. This is restricted primarily to the large producers in both eastern and western Canada which have the resources and technical capacity to carry out independent research, and whose scale of operations warrants R&D investments.

University researchers have traditionally restricted their involvement to academic interests in peat and peatlands. Research has been carried out in such areas as peatland development in terms of botanical succession, morphology, geochemistry, etc., palynology and paleoecology, peat chemistry and engineering properties. Recently, there has been greater involvement in the practical application of this knowledge. This has led to the involvement of university researchers in projects connected largely with the fuel-peat sector, particularly in peat chemistry and product development.

Although a diversity of interests is addressed in Canadian peat activities, the recent concentration of projects in the energy sector has led to the greater visibility of peat research and development in the country. Prior to fuel peat R&D, most research was isolated within the various agencies responsible for a particular field of interest.

At the federal level, fuel-peat R&D is now coordinated through the National Energy Program-sponsored Peat for Energy and Chemicals Program (The Peat Program). This is a multi-agency program involving the National Research Council of Canada, Environment Canada and Agriculture Canada. The program is funded through the Office for Energy Research and Development (OERD), in the Department of Energy, Mines and Resources Canada. The requirements of the program have resulted in the participation of departments and agencies with a long-standing involvement in peat R&D, such as the Land Resource Research Institute (Agriculture Canada) and the Canadian Forestry Service, but more importantly has resulted in the involvement of previously non-participating agencies, such as the Energy Division of the National Research Council, the Environmental Protection Service (Environment Canada) and numerous private industry groups and university researchers. The Peat Program is also served by an inter-departmental advisory board - Peat Forum.

Interest in the fuel-peat sector has had similar results of broadening the range of agencies involved in peat R&D at the provincial level. This is particularly notable in Newfoundland, Quebec and Ontario where fuel-peat interest and activities have involved numerous agencies. In Ontario interest in fuel-peat has led to the formation of an Interministerial Committee on Peat.

Interest in fuel-peat development potential has also resulted in the development of a national peat inventory methodology program (as a sub-section of the Peat Program) and numerous provincial peat resource inventories.

Policies and legislation of direct relevance to peat research and development and peatland management are scarce. This could be for several reasons. The topic is truly multidisciplinary and includes the involvement of many different agencies and groups. Activities in one sector are frequently felt and have implications in another. This arises when many different uses can be ascribed to the same peat resource. Therefore, assigning the responsibility of directing research and development in peat studies is not a clear-cut process. To date (and only very recently), coordinating responsibility has come via energy interests, but has not, at the federal level, involved the Department of Energy, Mines and Resources. The thrust has been in research and development and is managed through the National Research Council of Canada.

Departments and their agencies with direct involvement in peat and peat-related studies have not as yet defined their positions or long-term intentions in this area. Although projects are numerous, peat appears to be a low priority in most departments. The Coal Branch, Department of Energy, Mines and Resources is currently formulating a statement concerning the position of peat in that department, although the department's activity in peat is currently negligible.

There are various federal departmental policies and departmental strategies of a more general nature which could be indirectly applicable to peat. Included is the Federal Policy on Land Use which establishes general guiding principles for the wise management and use of all Canadian land resources. To date, peat-specific applications of the policy have been limited to Agriculture Canada's studies of productivity of organic soils. The policy could be more vigorously and directly applied to other peat land uses (e.g. forestry, wildlife management, recreation and waterfowl), but little progress has been made. In fact, peat was omitted from Environment Canada's Energy Strategy, although the Department is actively involved in fuel-peat projects. Peatland studies do not appear to be benefitting from the recent concern and interest in wetlands, although peatlands comprise an estimated 90 percent of all wetlands in Canada. This interest in wetlands is largely directed toward those which are imporant as waterfowl habitats.

Some progress is being made at the provincial level in peat-specific legislation. In general, responsibility for managing peatlands falls with Departments or Ministries of Mines and Lands. Peatland disposition, whether for horticultural peat moss development or fuel-peat activities, is carried out under the control of general pits and quarries legislation. Two provinces, New Brunswick and Ontario, have developed peat-specific disposition guidelines, and other provinces are now approaching the topic. However, as with the federal government, many provincial departments and agencies become involved in peatland development and management for various purposes - whether it be in industry, agriculture, wildlife management, forestry, recreation, etc. and have not as yet developed an integrated approach to peatland management.

B. Federal Government

i) Overview

Federal government involvement in peat studies is currently primarily research and development-oriented. Peat and peat-related projects are being carried out in the following broadly-defined areas:

- energy
- agriculture
- forestry
- land use
- environmental protection
- geotechnical research

As summarized in Figure 2: Federal Departments and Agencies Involved in Peat Initiatives, there are several federal agencies with programs and interests related to peat. Of these, five are most directly and heavily active in peat research and development:

- National Research Council - Energy Division
- Agriculture Canada - Research Branch (including the Land Resource Research Institute and several research stations across the country)
- Environment Canada - Environmental Protection Service; National Water Research Institute; Lands Directorate; Canadian Wildlife Service; Canadian Forestry Service
- Energy, Mines and Resources - Coal and Alternative Energy Branch
- National Defence - Defence Research Establishment (Suffield, Alberta).

Figure 2: FEDERAL DEPARTMENTS AND AGENCIES INVOLVED IN PEAT INITIATIVES

	Regional Industrial Expansion	Canadian International Development Agency	Indian and Northern Affairs	▨ National Defence	▨ Energy, Mines and Resources	▨ National Research Council	▨ Environment	▨ Agriculture
A. INTERNALLY-FUNDED INITIATIVES	Economic and Regional Development Agreements (Fed/Prov) Mineral Subsidiary Agreements (Fed/Prov)	International peat R&D assistance (pending)	reserve resource development (pending)	terrain analysis	peat policy (pending) Conservation and Renewable Energy Development Agreements (Fed/Prov)	geotechnical studies	land use monitoring ecological land surveys pollution studies wetland water-fowl habitat studies silviculture studies	organic soil classification methodology peat subsidence research
B. PEAT PROGRAM-FUNDED INITIATIVES	N/A	N/A	N/A	N/A	Peat Program funding coordination	Peat Program management mining and dewatering & standards research product development research	pollution control at source technology water sampling program national peatland inventory forest and plant ecology project environmental impact assessment and peatland ecology project	land use capability for organic soils research national peatland inventory methodology and wetland register

▨ most heavily and directly involved in peat initiatives

Projects associated with the various research areas may be divided into two broad categories: those which are conducted as part of broader internally-funded programs, and those associated with (and funded by) the Peat for Energy and Chemicals Program, sponsored by the National Energy Program and managed by the National Research Council. In some instances - particularly in agriculture and forestry - there is considerable overlap between the internally-funded initiatives and the Peat Program projects. However, in general the internal departmental projects are being carried out as part of larger programs which have been in progress for some time, whereas Peat Program projects are new (two to three years old at most) and frequently have developed where no peat-related studies previously existed. These projects have been designed to address the specific requirements of the Peat Program.

Agencies which are involved in both internal and Peat Program-related projects include the Land Resource Research Institute, (Agriculture Canada) and the Canadian Forestry Service (Environment Canada). Agencies involved in peat and peat-related projects which are independent of the Peat Program include the Lands Directorate and the Canadian Wildlife Service (Environment Canada); the Coal and Alternative Energy Branch (Energy, Mines and Resources) and the Department of National Defence. Agencies which operate peat-projects only as part of the Peat Program include the Energy Division (National Research Council) and the Environmental Protection Service (Environment Canada).

Future involvement can also be expected from the Canadian International Development Agency (CIDA) and Indian and Northern Affairs Canada (INAC). Peat development is being promoted in developing countries and CIDA was recently approached by the Senegalese Government concerning possible involvement in peat development in that country. Several Indian reserves in Canada have also indicated an interest in developing peat bogs on their land, primarily for horticultural peat moss. This has required involvement from INAC, but the Department has not as yet become directly involved in any peat-related projects. However, should interest in peat development in northern Canada emerge, responsibility for this activity would certainly involve this department.

Originally, peat research and development was concerned primarily with geotechnical investigations of peat or muskeg. The National Research Council and the Department of National Defence have been involved in such studies since the 1950s. Research has been directed toward overcoming the obstacles which peatlands pose to northern development, including access to northern areas. This research has included addressing the problems associated with such activities as construction, transportation, and pipelines routing.

Agriculture and forestry have been practised on peatlands in Canada for a number of years. Agricultural research into the problems associated with organic soils has been a focus for peat activities over the past 25 years. Investigation of problems associated with improved yields and management techniques on organic soils has been addressed on a continuing basis at several Agriculture Canada research stations across the country.

The Canadian Forestry Service of Environment Canada has had some involvement in peatlands through the study of peatland environments occurring within major forest regions, particularly the boreal forest zone. Some research activity is now being directed toward the development of peatland forestry techiques.

The newest interest in peat has been in the energy sector. The focus of this activity has been the research and development of Canadian fuel-peat technology and is being carried out under the National Energy Program (NEP) sponsored Peat for Energy and Chemicals Program. In addition to developing a new area of peat research interest in the federal government, this program is also the first federal government program organized with the specific purpose of studying peat and is the first peat program to involve a number of different agencies and branches from several departments. In addition to developing fuel peat technology, a number of other aspects of developing a fuel peat industry are being addressed at the federal level. These include an accurate, national inventory of the resource, solutions related to environmental concerns and post-development reclamation techniques. The program is therefore dependent on the coordinated efforts of the various government agencies involved in the program.

ii) Policy and Legislation

The federal government influences peat research and development activities through its land use, environment and resource management policies and through legislation related to land use and energy development.

- ### Federal Policy on Land Use

In April, 1981, the Minister of the Environment released the "Federal Policy on Land Use". The policy is very general in nature and open to broad interpretation. There are, however, several aspects of the policy which could have a direct or indirect impact on peatlands.

The first of the two policy statements which could have direct application to wetlands addresses the issue of conservation and preservation:

- "The federal government will identify and, as appropriate, protect through designation or acquisition, lands of particular value to the nation because of historical, cultural, recreational, aesthetic or ecological importance."

The National Parks Act, Historical Sites and Movements Act, Territorial Lands Act, Canadian Wildlife Act and Migratory Birds Convention Act will be used to accomplish these goals. The programs referred to in this statement would probably include the Wetland Evaluation Program being carried out by the Canadian Wildlife Service.

The second policy statement which could have direct application to wetlands is oriented toward land management and land use:

- "The federal government will provide a coordinated program of surveys and socio-economic, scientific and technical research on land capability, characteristics, tenure and use.

Surveys and research in the fields of:

- geological surveys
- topographic mapping
- soils
- ecological mapping
- social, economic and environmental aspects of land use
- identification of critical lands
- land-use monitoring
- forest inventories
- water surveys
- collection of socio-economic data relating to land use

are key elements in the formulation of sound land-management strategies by all who influence the use of land."

The wetland component of Environment Canada's Canada Land Use Monitoring Program (CLUMP) could be considered as part of the surveys and research being carried out in land-use monitoring. The Environment Canada's Lands Directorate activities in the National Wetlands Working Group can similarly be identified as a component of surveys and research in ecological mapping. Forest inventory research has extended to encompass activities in peatland inventory methodology. The Organic Soils Program, the Peatland Reclamation Program and the Peatland Inventory Methodology studies of the Land Resource Research Institute of Agriculture Canada contribute to survey and research in the field of soils.

The federal government land use policy will also consider the impact of policies and programs on:

- watersheds, aquifers, recharge and storage areas, and other lands critical to the quality and quantity of the nation's water

- lands which are of particular value because of historical, cultural, recreational, aesthetic or ecological importance

- fragile and critical habitats
- land with high agricultural capacity
- land with high forestry capacity
- the use and development of lands with potential for production of non-renewable resources such as minerals, hydrocarbons and aggregates will be considered.

In all cases appropriate action, under the previously stated legislation, will be taken to ensure the value of the lands is maintained.

- Federal Policy on Energy

When the National Energy Program (NEP) was announced in October 1980 it stressed the goal of Canadian crude-oil self-sufficiency by 1990 through the development of indigenous fuel resources. The various alternative energy options referred to in this program are known collectively as the "off-oil" policies.

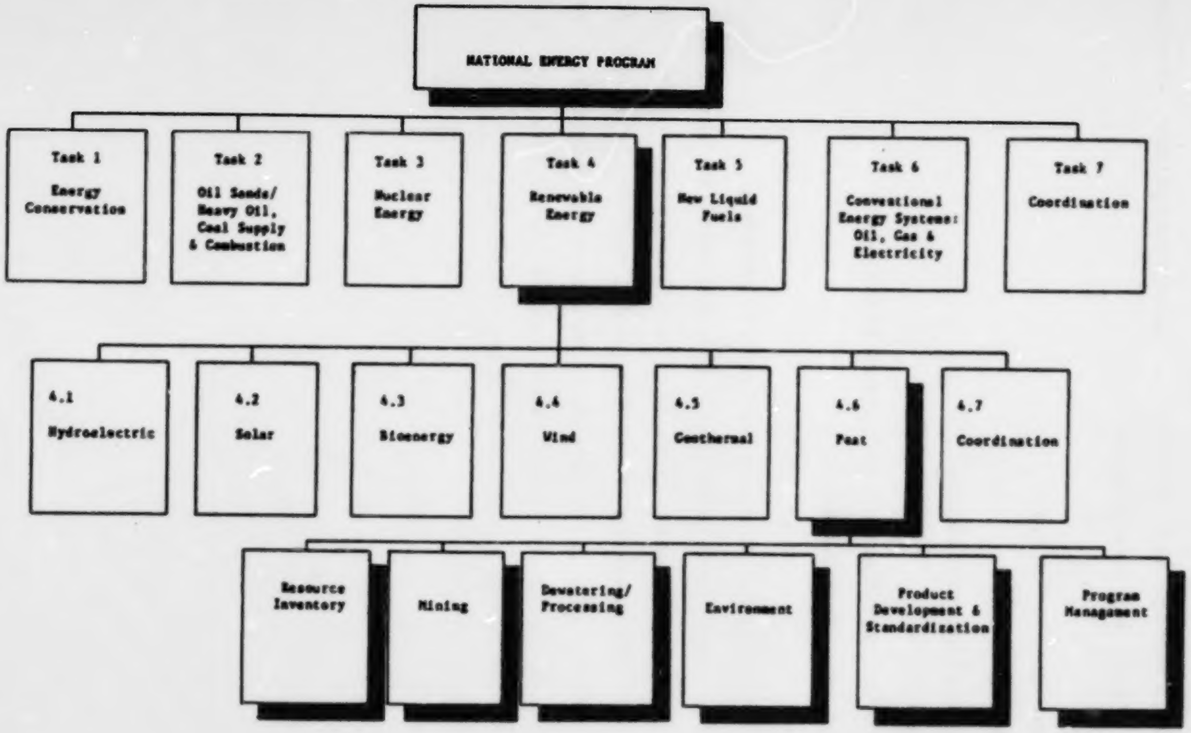
In response to the need for basic R&D in the energy sector, the National Energy Program (NEP) Peat for Energy and Chemicals Program (The Peat Program) was established as part of the NEP in fiscal year 1982-83. The Peat Program is one of seven program elements organized under Task 4 - Renewable Energy of the NEP and is managed by the National Research Council of Canada (see Figure 3: The Peat Program Within the National Energy Program). Funds are allocated to the Peat Program via the Office of Energy, Research and Development of the Department of Energy, Mines and Resources (EMR).

The Peat Program has adopted a multidisciplinary approach and is organized into six sub-programs:

- resource inventory
- mining
- dewatering/processing
- environment
- product development and standardization
- and program management

Three federal government departments implement a number of projects within the above sub-programs: the National Research Council (Energy Division); Environment Canada (Environmental Protection Service, National Water Research Institute and Canadian Forestry Service); and Agriculture Canada (Land Resource Research Institute). Some projects are conducted with in-house resources while others are sub-contracted to other government agencies or private industry.

Figure 3: THE PEAT PROGRAM WITHIN THE NATIONAL ENERGY PROGRAM


NATIONAL ENERGY PROGRAM
Task 1 Energy Conservation
Task 2 Oil Sands/ Heavy Oil, Coal Supply & Combustion
Task 3 Nuclear Energy
Task 4 Renewable Energy
Task 5 New Liquid Fuels
Task 6 Conventional Energy Systems: Oil, Gas & Electricity
Task 7 Coordination
4.1 Hydroelectric
4.2 Solar
4.3 Bioenergy
4.4 Wind
4.5 Geothermal
4.6 Peat
4.7 Coordination
Resource Inventory
Mining
Dewatering/ Processing
Environment
Product Development & Standardization
Program Management

iii) Agency Activities

The major policy responsibilities, interests and program activities of those federal departments and agencies most heavily and directly involved in peat issues are highlighted below. (More detailed descriptions are provided in Volume II of this report.)

- National Research Council (NRC)

  The National Research Council manages the NEP Peat Program as well as undertaking contract and in-house research projects within this program.

  The contracted peat research activities of the National Research Council are managed by the Energy Division and are organized according to the following sub-programs:

  - Mining
  - Dewatering and Processing, including combustion
  - Product Development and Standardization

  There are two in-house projects, referred to as the Atlantic Research Laboratory-Peat Projects: 1. Peat Processing and Product Development and 2. Peat Standards and Testing. These projects began in fiscal year 1983/84 and will operate until the end of the Program in 1987/88. Work in the first category is now concentrating on projects closely associated with wet-mining and the pre-treatment and processing of peat slurries. The objectives of the second project are to develop standards and testing techniques which will allow quantitative characterization of peat and peat products.

- Energy, Mines and Resources (EMR)

  Establishing responsibility for peat at EMR was difficult because of lack of clarity regarding the classification of peat as a renewable or non-renewable resource. Also the Coal and Alternative Energy Branch does not have an R&D mandate even though peat is considered an alternative fuel. However, the Coal Division is in the final stage of preparing a statement on peat.

The Demonstration Section of the Renewable Energy Division of the Coal and Alternative Energy Branch has been responsible for managing the Conservation and Renewable Energy Demonstration Agreements Program (CREDA) (1979-1984) which included three peat demonstration projects funded jointly with the participating provinces. These projects include:

- Bishop's Falls Fuel Peat Demonstration Project (Newfoundland)
  - demonstrate the feasibility of mining fuel peat using the Haku and vacuum harvesting methods
  - demonstrate the feasibility of burning peat in an industrial setting

- St. Shott's Peat Harvesting Project (Newfoundland)
  - demonstrate the feasibility of mining fuel peat

- Buffalo Narrows Fuel-Peat Demonstration Project (Saskatchewan)
  - demonstrate the feasibility of producing and utilizing sod peat for domestic heating purposes in a remote northern community

CREDA has now been replaced with ENERDEMO. There are currently no further plans for fuel-peat demonstration projects under the new agreements.

- Department of National Defence

The Defence Research Establishment of the Department of National Defence has been conducting on-going investigations to solve the problems associated with off-road terrain mobility. The program, which is coordinated through the Vehicle Mobility Section in Suffield, Alberta, has been concerned with various types of terrain, including vegetated surfaces as well as sand, snow and muskeg (or peatlands). The investigations comprising the projects have been carried out under contract with university researchers, and have concentrated on two main areas of interest. The first has been to develop suitable methods of terrain analysis and the second to improve the performance of vehicles on difficult terrain.

- Agriculture Canada

Agriculture Canada is involved in peat and peat-related research through the activities of the Land Resource Research Institute (LRRI) and a number of Research Stations throughout the country. The LRRI and the Research Stations are part of the Research Branch of Agriculture Canada. The Land Resource Research Institute (LRRI) has a general mandate to manage and to conserve Canada's land and soil resources and to improve the capability of these resources for agriculture.

The LRRI has been carrying out research to investigate ways of improving the land-use capability of peatlands and to develop a national inventory methodology for peatlands. The Soil Classification Research Group is responsible for improving the land-use capability of the resource, while inventory methodology is the responsibility of the Soil Survey Group. The Soil Classification Research Group has been involved in three activities under its on-going Organic Soil Program:

- investigations of the botanical composition of peat to help identify the origin of the peat material and plant micro-fossils
- rubbed fibre tests to improve humification testing
- studies of special problems in peatland cultivation, particularly subsidence in peat soils

More recently, preparation of a land use capability for organic soils has been undertaken. This includes the peatland reclamation research which is receiving funding from the NEP Peat Program. Development of a national peatland inventory methodology and wetland registry is being undertaken by the Soil Survey Group, also with funding from the NEP-Peat Program.

Research comprising investigation of subsidence in peat soils, vegetable production, forage crop production and improved grazing land is being carried out by several research stations across the country as part of on-going internally-funded programs.

- Environment Canada

Environment Canada has no internally-funded programs dealing specifically with peat or peatlands. However, peatlands are studied within the context of numerous projects concerned with environments containing peatlands (e.g. wetlands and forests).

The Environmental Protection Service of Environment Canada has the responsibility for coordinating and managing a series of projects under the Environment sub-program of the NEP-Peat Program. These projects comprise the "Pollution Control at Source" environmental protection aspects of developing peat for energy. As such, they define (in part) the objectives of the Environment sub-program to develop environmental protection criteria and pollution-abatement technologies for peat harvesting and processing techniques.

The National Water Research Institute (NWRI) is currently conducting a sampling program to characterize bog and receiving water chemistry both prior to and during mining activities. The sampling program began in fiscal year 1983/84 at various horticultural peat sites across the country and was carried out on behalf of EPS to provide baseline information for the "Pollution Control at Source" research program. The NWRI sampling project is now receiving funds directly from the NEP-Peat Program through the Panel for Energy Research and Development (PERD).

The Lands Directorate regards peatlands as wetlands and, as such, they are studied within the context of three Lands Directorate Programs:

- Ecological Land Survey (ELS) Research Program
- Long Range Transport of Airborne Pollution (LRTAP) Program
- Canada Land Use Monitoring Program (CLUMP)

The ELS program is a part of the work carried out under the Canada Committe on Ecological Land Use Classification (CCELC). The wetland concerns of this Program are integrated with the activities of the National Wetlands Working Group. The Lands Directorate provides a secretariat for CCELC and publishes some of the work resulting from the committee, including Wetlands of Canada (1981) - a folio of maps on Wetlands Regions and Wetlands Distribution.

LRTAP research is concerned with mapping the potential sensitivity of terrestrial ecosystems to the effects of acid precipitation. Wetlands are being investigated as part of a major research project being carried out by the Lands Directorate in cooperation with the National Water Research Institute (NWRI).

The Lands Directorate's main wetlands research program began in 1983 as part of the Canada Land Use Monitoring Program - CLUMP. Under CLUMP, Prime Wetlands research focuses on wetlands as an area of national concern, placing particular emphasis on the loss of wetlands, or wetland conversion, in southern Canada.

The Canadian Forestry Service has a limited involvement in peat-related research related to its mandate to conduct research in aid of forest management. Peat-related research is being conducted at three Forest Research Centres:

- Great Lakes Forest Research Centre (Sault St. Marie) - peatland ecology is being studied under the Black Spruce Ecosystem Silviculture Project

- Newfoundland Forest Research Centre (St. John's) - peatland ecology has been studied to a limited extent since 1975 under the on-going Forest and Plant Ecology projects

- Northern Forest Research Centre (Edmonton) - peat-related studies are being carried out under an Environmental Impact Assessment and Peatland Ecology project.

The Canadian Wildlife Service studies peatlands in a limited manner, only when they appear to offer waterfowl habitat.

iv) Coordinating Organizations

Following is a brief description of four organizations which have been established specifically for the purpose of coordinating peat-related activities at the federal level.

Peat Forum - is a committee comprised of technical experts from several federal government departments with an interest in peat. Peat Forum acts as a technical advisory committee to the Peat Program in matters concerning the evaluation of proposals for contracts awarded through the program. The committee, established in 1981, is chaired by NRC and has members from the Departments of Environment; Energy, Mines and Resources; Agriculture; Indian Affairs and Northern Development.

Peat Environmental Committee - chaired by the Environment Protection Service, Environment Canada, this committee meets annually to discuss current and proposed projects of relevance to environment concerns regarding peatland development. The committee has a variable membership but invites participation from other EC agencies and federal government departments, provincial government agencies, the private sector and universities.

Peatland Subcommittee of the NRC Associate Committee on Geotechnical Research - undoubtedly the oldest committee in Canada concerned with peat, this group was established in 1947 as the Muskeg Subcommittee. The committee has sponsored 18 conferences devoted to muskeg research. Its role has been to identify problem areas concerning the geotechnical aspects of peatland utilization and to advise the Associate Committee on research needs in this field as well as to promote research. The committee is comprised of members drawn largely from the engineering community in federal government agencies, universities and private industry.

The National Wetlands Working Group - chaired by the Land Resource Research Institute, Agriculture Canada, the working group was established in 1975 as a sub-committee of the Canadian Committee on Ecological Land Classification. The working group includes members from federal and provincial agencies, universities and private industry. Each province has its own working group or chapter with a provincial chairperson. The aim of the working group is to provide coordination and expertise on various aspects of resource and ecological assessment pertaining to all wetland types.

C. Provincial Governments

i) Overview

All provincial governments have been involved in peat research and development activities to varying extents, principally through their departments of Mines, Energy, Natural Resources and/or Agriculture. Figure 4: Peat-Related Activities of Provincial Departments and Agencies summarizes, for each province, the major departments and agencies involved in each of a range of peat activities (regulation; agriculture; horticulture; marketing; fuel; wildlife management; and resource inventory).

For resource disposition purposes, peat is considered a surficial material in all provinces, and a Quarry Permit is required under provincial Mines Acts for its removal. In Quebec, Saskatchewan and British Columbia permission must also be obtained from the corresponding departments of Agriculture.

Provincial government involvement in peat-related activities to date has been greatest in the east, where the energy crisis prompted provinces dependent on western and imported petroleum fuels to investigate alternative energy sources.

Research and development activities related to horticultural, fuel and agricultural uses of peat have been undertaken by Newfoundland, New Brunswick, Nova Scotia, Quebec and Ontario. These provinces have, or are developing:

- inventories of their peat resources
- disposition regulations specific to peat
- policies to manage their peatlands

New Brunswick and Quebec have also undertaken marketing research for peat products.

In the western provinces, departments of Agriculture have been the lead agencies in peat R&D and peatland management. Alberta and British Columbia have undertaken, respectively, a technology-transfer project and an agricultural improvement project. The Departments of Energy and Mines in Manitoba and Mineral Resources in Saskatchewan have undertaken some preliminary estimates of their horticultural peat reserves. Saskatchewan was the only western province involved in fuel peat development (through a CREDA program). However, the province withdrew its support before the end of the project.

Figure 4: PEAT-RELATED ACTIVITIES OF PROVINCIAL DEPARTMENTS AND AGENCIES

PROVINCE	DEPARTMENT/ AGENCY	AREA OF PEAT-RELATED ACTIVITY:						
		Regulation	Agriculture	Horticulture	Marketing/ Coordination	Fuel/ Industrial	Wildlife Management/ Forestry	Resource Inventory
Newfoundland	Rural Agriculture and Northern Development		ADSA, vegetable, sod specialty crop production		Peatland Coordinator			
	Mines and Energy	Quarry Materials Act				CREDA - fuel-peat mining industrial burning		Peatland Inventory S.W. Quadrant
	Development				Market study			
Prince Edward Island	Energy and Forestry	Planning Act Excavation Pits Regulations						
Nova Scotia	Mines and Energy	Mining Act				Feasibility Study of fuel-peat demonstration project		Peatland Inventory Program
	Lands and Forests						Classify and evaluate wetlands for wildlife management	Classify and evaluate wetlands for wildlife
New Brunswick	Commerce and Development			Policy on Financial Assistance to Peat Producers		Industrial uses of peat of North-eastern New Brunswick		
	Community Improvement Corporation					Administers funding for activities		Administers funding for activities
	Energy Secretariat					CREDA - test burn of peat to produce heat and steam		
	Natural Resources	Quarriable Substances Act		Crown Peat Resources Management Policy				Peat Resource Evaluation Program

Figure 4: PEAT-RELATED ACTIVITIES OF PROVINCIAL DEPARTMENTS AND AGENCIES (cont'd)

PROVINCE	DEPARTMENT/ AGENCY	AREA OF PEAT-RELATED ACTIVITY:						
		Regulation	Agriculture	Horticulture	Marketing/ Coordination	Fuel/ Industrial	Wildlife Management/ Forestry	Resource Inventory
Quebec	Energy and Resources	Mining Law				Biomass Energy Production Studies		Horticultural Peat Inventory
	Agriculture	Act to Preserve Agricultural Land						
	Centre de Recherche Industriel du Québec					Biomass Energy Production Studies		
	Institut de Recherche d'Hydro Québec					Biomass Energy Production Studies		
Ontario	Energy				Inter-ministerial Committee on Peat	Feasibility Study of Peat as a Fuel in Ontario		
	Natural Resources	Mining Act; Peat Disposition Guidelines Public Lands Act			Inter-ministerial Committee on Peat	Feasibility Study of Peat as a Fuel in Ontario Forest	Guidelines for Wetlands Management; Wetland Evaluation Program; Conservation Authorities; Forest Drainage in Black Spruce Forest Stands in North-western Ont.	Fuel Peat Inventory Program
	Northern				Inter-ministerial Committee on Peat	Feasibility Study of Peat as a Fuel in Ontario		
Manitoba	Energy and Mines	Mines Act						Horticultural Inventory
	Agriculture	Department of Agriculture Act						

Figure 4: PEAT-RELATED ACTIVITIES OF PROVINCIAL DEPARTMENTS AND AGENCIES (cont'd)

PROVINCE	DEPARTMENT/ AGENCY	AREA OF PEAT-RELATED ACTIVITY:						
		Regulation	Agriculture	Horticulture	Marketing/ Coordination	Fuel/ Industrial	Wildlife Management/ Forestry	Resource Inventory
Saskatchewan	Mines and Energy	Mines Act		Carrot River Peat Moss - a Saskatchewan Minerals Corporation		Economic and technical feasibility study; CREDA - fuel-peat mining and domestic heating		Fuel-Peat Resource Program
	Agriculture	Agriculture Department Act						
Alberta	Energy and Natural Resources	Public Lands Act; Surface Minerals Regulations					Peatland Forestry Study	Alberta Peatland Inventory Methodology Study
	Environment	Guidelines for the Orderly Development of the Commercial Peat Industry in Alberta						
	Agriculture		Technological Assessment and Improvement Program					
British Columbia	Agriculture and Food	Agricultural Land Commission Act	Wetland Meadows Development Program					
	Lands, Parks and Housing	Land Act						

ii) Agency Activities

The major jurisdictional and policy responsibilities, interests and program activities of key provincial agencies involved in peat issues are summarized below. (More detailed descriptions are provided in Volume II of this report.)

- Newfoundland

In Newfoundland, peat research and development activities are undertaken by three departments - Rural Agriculture and Northern Development; Mines and Energy, and the Department of Development. Over the past 25 years the Agricultural Development Branch of the Department of Rural Agriculture and Northern Development has been involved in projects to improve peatlands for grazing and forage crop production. The Branch also has a peatland Coordinator to oversee these activities.

Between 1978 and 1984 the Department participated in the Canada/Newfoundland Agricultural Development Subsidiary Agreement (ADSA) with joint funding from the then federal Department of Regional Economic Expansion (DREE) and a new agreement is expected to be reached by March, 1985 with the new federal Department of Regional Industrial Expansion (DRIE). The objectives of the agreement program focus on technology transfer, information exchange and education. Funding was approved for three peatland projects: a) Vegetable, b) Sod, c) Specialty Crop Production on Peatland.

The Mines Branch of the Department of Mines and Energy is responsible for managing peat disposition under the Quarry Materials Act and is also responsible for completing the provincial peat inventory. The Energy Branch of the Department had the responsibility for managing the joint provincial/federal Conservation and Renewable Energy Demonstration Agreement (CREDA) projects for peat fuel development at Bishop's Falls and St. Shott's.

The Department of Development has undertaken market studies with regard to peat products.

- **Prince Edward Island**

There is a limited amount of crown-owned peatlands in Prince Edward Island. If peat R&D activities were to occur, the Department of Energy and Forestry would assume this responsibility.

- **Nova Scotia**

In 1979, the provincial government declared it would work toward energy self-sufficiency. While development of the province's off-shore petroleum and coal resources has received the greatest government commitment, some interest has been directed toward the province's peat resource as a possible source for energy development.

The Resource Energy Division of the Department of Mines and Energy is involved in the Peatland Inventory Program (1979 - 1985) to determine the extent of the fuel peat resource in the province. The Program is being funded through a Mineral Development Subsidiary Agreement with the federal Department of Regional Industrial Expansion (DRIE). A feasibility study of developing a fuel peat industry in southwestern Nova Scotia has also recently been completed.

Other provincial government interest in peatlands has been expressed by the Department of Lands and Forests. The department has undertaken a program to classify and evaluate the province's wetlands for the purpose of wildlife management.

- **New Brunswick**

All peat-related provincial government activity in New Brunswick has been dependent on funding from the Mineral Development Subsidiary Agreements existing for the past ten years between the Department of Regional Economic Expansion (DREE) and the provincial government. (To replace these, new agreements are being negotiated under the Economic and Regional Development Agreements involving the new federal

Department of Regional Industrial Expansion (DRIE)). Program funds have been used to fund a variety of projects ranging from market studies for peat products to participate in an international peat symposium in 1982.

To combat the current difficulties of peat producers caused largely as a result of overproduction, the Department of Commerce and Development has adopted a policy on Financial Assistance to Peat Producers. The policy encourages the development of secondary producers - producers of peat-based products - and discourages any further growth of the primary horticultural peat production capacity.

The New Brunswick Energy Secretariat was established in 1978 to manage the Federal/Provincial Conservation and Renewable Energy Demonstration Agreement (CREDA) for the province. One fuel-peat demonstration project was proposed through the CREDA program, involving the test-burning of peat at Jiffy Products N.B. Ltd. in Shippegan to produce heat and steam for plant operations.

The Mineral Development Branch of the Department of Natural Resources is responsible for evaluating and regulating the use of provincial peat resources. This branch was responsible for carrying out the New Brunswick Peat Resource Evaluation Programme - the most comprehensive peat inventory available in Canada.

The Mineral Development Branch also administers the Quarriable Substances Act and the Crown Peat Resource Management Policy under the Act. The policy established a review procedure, including an Interdepartmental Peat Committee, to assess proposed peat developments in terms of market impact. Potential environmental impacts are also receiving greater attention.

- Québec

In Québec, the Ministry of Energy and Resources has the jurisdiction, development and management responsibilities for peat. The Energy and Mining Division of the Ministry as well as the crown corporations Institute de Recherche d'Hydro-Québec (IREQ), Hydro-Québec, and Centre de Recherche Industriel du Québec (CRIQ), have all been involved in peat-energy activities. The Ministry of Energy and IREQ were involved in the development of the Anticosti Island peat gasification project between 1978 and 1984. Hydro-Québec commissioned a feasibility study of constructing and operating a 268 Megawatt (MW) peat-fired generating station in 1979. Interest is now directed toward developing technologies that can be used for biomass energy production in general.

Although energy has been the recent focus of government interest in Québec, the Mining Division of the Ministry of Mines and Energy has been involved in an on-going horticultural peat inventory program since 1965.

The Mining Division is also responsible for peat disposition under the Mining Law. In addition, the Ministry of Agriculture must grant approval as much of the peatlands in Québec are subject to the Act to Preserve Agricultural Land. Approval from the Ministry of the Environment is also required before obtaining a licence.

- Ontario

In 1979, the Ontario Ministry of Energy established a new energy security target for the province. The policy, Energy Security for the Eighties: A Policy for Ontario, stated a commitment to satisfy one percent of the provincial energy requirements with peat. The Ministry has commissioned a number of studies and projects investigating both the economic and technical feasibility of peat development in conjunction with the Ministries of Northern Affairs and Natural Resources.

The Ministry of Natural Resources (MNR) has the broadest interest in peat, as its mandate is to manage provincial resources, to undertake peatland inventories, and to evaluate and regulate the resource. At least three branches and one regional office of the Ministry are currently involved in peat-related activities:

- Ontario Geological Survey - Fuel Peat Inventory Program using Ontario Centre for Remote Sensing inventory methods
- Land Management Branch - Disposition of peatlands
- Wildlife Branch - Wetland Evaluation Program
- OMNR - Northern Region - Operational Forest Drainage in Peatland Black Forest Stands in Northeastern Ontario
- Conservation Authorities - water retention and flood management

Ontario is the only province with an Interministerial Committee on Peat to stimulate interest and coordinate activities concerning the development of provincial peat resources. The Committee is constituted initially for three years and is composed of representatives from the Ministries of Natural Resources, Energy, and Northern Affairs.

The Mining Lands Section of the Land Management Branch (MNR) is currently revising its Peat Disposition policy. The peat disposition mechanism governing horticultural land use is the Public Lands Act. The Quarry Permit applies to peat extraction. The MNR's Guidelines for Wetlands Management present another land use consideration applicable to peatlands.

- Manitoba

The department of Energy and Mines is responsible for managing the province's peat resource. The Mineral Resources Division has carried out some preliminary inventories of horticultural peat in the south of the province. A project is now underway to determine the best way to map the extensive peatlands in the Hudson Bay Lowlands.

Peatland use is implicitly regulated under the Quarrying Minerals Regulations of the Mines Act. There are no guidelines or special disposition mechanisms for peatland use and peat extraction is exempt from rehabilitation regulations.

- Saskatchewan

Peat studies in Saskatchewan began on a modest scale in 1974 in response to a number of inquiries concerning horticultural peat and peat as a source of energy. The then Saskatchewan Mineral Resources Department concentrated its investigations in the Carrot River/Hudson Bay area where the province's only horticultural peat moss producer, Carrot River Peat Moss - a Saskatchewan Minerals Corporation - is now in production. This was followed by a reconnaissance program, known as the Fuel Peat Resource Program, which ran from 1977 to 1979. (The increased costs of conventional energy sources in the remote communities of this region had led to the interest in developing this program.) In addition to the reconnaissance studies, an evaluation of the technical and economic feasibility of development and utilization was carried out and was completed in 1979.

Following feasibility studies carried out by the Saskatchewan Geological Survey and Department of Mineral Resources with funding from the then federal Department of Regional Economic Expansion (DREE), the Buffalo Narrows Fuel Peat Demonstration Project under a Conservation and Renewable Energy Development Agreement (CREDA) was established. The practical Demonstration Project began in the fall of 1981 and continued until August 1983 when it was discontinued prematurely due to provincial budgetary restraints.

Two departments are responsible for the regulation of peat and peatlands in Saskatchewan. The Department of Agriculture has a large part of the provincial land under its jurisdiction and it regulates peat moss use, while the Department of Mines and Energy regulates fuel peat use. If fuel peat removal is desired, a permit from the Department of Agriculture for removal of the horticultural peat layer is generally required, as is a lease from the Department of Mines and Energy.

- Alberta

Peat is a new topic of interest for Alberta government agencies. A province-wide inventory of peatlands in Alberta is currently being considered by the Resource Evaluation and Planning Branch of the Department of Energy and Natural Resources in response to horticultural peat moss industry requests for information on peat areas and types. A pilot project, contracted to the Alberta Research Council, has been established to recommend an appropriate methodology for an Alberta Peatland Inventory.

The Department of Agriculture's Agricultural Processing Development Branch has the responsibility of providing a liaison between the Department and the province's peat moss producers. Technology transfer is the main objective of this liaison.

Peatland development is subject to the Public Lands Act - Surface Materials Regulations, administered by the Land Management Division, Department of Energy and Natural Resources.

- British Columbia

Peat as a potential source of energy has not been identified as being of particular interest or importance by the Ministry of Energy, Mines and Petroleum Resources in B.C. The area in which peatlands have been receiving most provincial attention has been agricultural development. The Ministry of Agriculture and Food has been studying the agricultural uses and problems associated with peatlands in the interior of the province and in the Fraser River Delta area. The Wetland Meadows Development Program was introduced to encourage the development of organic wetland areas (peatlands) for forage crop production in the interior. This work has been undertaken by the department through an Agricultural and Rural Development Agreement (ARDA) jointly funded by the federal Department of Regional Economic Expansion (DREE). The problems of overcropping on organic soils in the Fraser River Delta are not yet being specifically addressed by the department. Issues of drainage, soil fertility and cropping fall under the department's regular soil programs.

Where peatlands - or organic soils - exhibit agricultural potential, they are incorporated into an Agricultural Land Reserve and may be used only for agricultural purposes. This would generally preclude any development other than for agriculture. However, a disposition mechanism for peat extraction does exist. The Ministry of Lands, Parks and Housing administers the Land Act which includes peat as a material that may be removed from Crown lands upon obtaining a licence or lease.

iii) Coordinating Organizations

Following is a brief description of organizations which have been established for the purpose of coordinating peat-related activities both within and among the provinces.

Peat Technical Working Group - Interprovincial Advisory Committee on Energy - the Working Group was established in 1981 with the intent of achieving the following objectives:

- strengthen communication with and between the government and the private sector
- identify and advise the NRC and other groups of projects eligible for funding
- encourage the development of demonstration projects
- ensure adequate exposure and future funding in peat-related areas

Only provinces in Eastern Canada have been particularly active.

Interministerial Committee on Peat (Ontario) - was established in march 1984 and is comprised of permanent members from the three Ontario ministries: Natural Resources, Energy, and Northern Affairs. The Committee will be constituted for an initial three year period which may be extended if the need for a permanent peat committee becomes apparent. The main concerns of the committee will be to identify directions for peat development in Ontario, direct available funds from participating ministries to development projects, encourage a greater interest in peat resource development in the province and provide a government focal point for the public with regard to peat and peat-related matters.

Newfoundland-Labrador Peat Association - is the only provincial peat association in Canada. It was formed in 1977 following a symposium on the peatlands of Newfoundland-Labrador, sponsored by the Memorial University of Newfoundland. Once associated with the Canadian National Committee-International Peat Society, the Association is now an autonomous group. The Association was formed with the intent to raise public awareness of the resource potential of peat in the province. The association meets on a quarterly basis and meetings are a balance between themes of general interest to the public and those of a technical nature. The Association has its own publication - Peat News - which is published quarterly. The Association is strictly regionally-oriented and participates in considerable interaction between the federal and provincial governments, industry and university members. One interesting activity is the current intent to acquire a lease for a local bog which would be used by the Association for small research projects, for testing equipment and as a supply of horticultural and fuel-peat to participatory members.

D. Private Sector

i) Overview

The private sector interest in peat and peatlands is composed of four groups:

- private industry
- universities
- consultants
- conservation and environmental groups

Private industry exhibits the most specialized interest in peatlands - the use of peat for commercial horticultural purposes. Horticultural applications constitute the only current commercial uses of peat in Canada. The horticulture peat industry has existed for as long as forty years in Canada and is currently active across Canada.

Universities have the broadest interest in peat and peatlands. University research has included biological, geographical, chemical and agricultural studies of peatlands. Recently, energy-related activities have been encouraged by the NEP-Peat Program funding.

Consultants have only recently become involved in peat-related activities, as a result of federal and provincial government requests funded by such programs as the Peat Program. Consultants' activities have ranged from surveying the resource, to developing technology suited to peat fuel extraction to assisting in the development of policy on peat use and management.

Environmental groups have been involved in wetland conservation efforts for over 25 years but peatlands are only now emerging as a separate conservation issue.

ii) Activities

. Private Industry

The Canadian peat industry is based almost solely on the production of horticultural peat moss. Although it is a small industry with a low national profile, it has significant regional importance, particularly in eastern Québec and northeastern New Brunswick. The industry has been developing independently over the past 40 years and has traditionally been comprised of small, family-owned operations. In recent years, this has been changing as production becomes dominated by a small number of larger producers.

Peat moss is most commonly used as a soil ameliorator, providing the organic matter which improves soil structure and thus the water-holding capacity and aeration properties of the soil. It is also used as a growing medium for seedlings, primarily in greenhouses. There are a few specialty products on the market, and the large producers are now developing and marketing special peat mixes with nutrient additives and soil mixes. Commercial greenhouses and home gardeners (i.e. retail sales) are the two most important peat moss user groups.

Canadian peat moss producers export approximately 90 percent of their product to foreign consumers, predominantly to the United States. "Off-shore" markets such as those in central Europe, Japan and the middle east are poorly-developed but are seen as potential markets for the future.

Sixty percent of the country's peat moss production is concentrated in eastern Canada, essentially in southeastern Quebec with 40 companies (35 percent of production) and northeastern New Brunswick with 17 companies (25 percent of production). There is only very minor activity in Nova Scotia and Prince Edward Island, and peat moss is currently not being produced commercially in Newfoundland. Eastern Canadian peat moss production is exported primarily to the eastern seaboard of the United States.

Although Ontario has vast peat resources, it does not have a significant peat moss industry. There is one small commercial producer operating in the Niagara region but total production is exported to the United States. Ontario imports peat moss from Québec and New Brunswick.

Western Canadian commercial production is not as intensive as in the east and there are far fewer producers involved. Production in this region is dominated by the British subsidiary Fisons-Western Corporation which has harvesting operations in central Alberta and southeastern Manitoba. There are three smaller producers also operating in central Alberta. In Saskatchewan, peat moss harvesting is carried out by the provincially-owned Carrot River Peat Moss company. As of summer, 1984, Fisons Western ceased its mining operations in the Delta on the southwest coast of British Columbia. This was the only commercial peat moss producer operating in British Columbia.

The largest market for western production is in California. Manitoba also exports its product to a large market in the central United States and the midwest. Four million bales per year are produced in the west.

In both eastern and western Canada the Canadian peat moss industry has been experiencing difficulties. In eastern Canada, the problem is due primarily to over-production and the fierce competition amongst the numerous producers. In both Québec and New Brunswick, several alternative products have been identified as being possible or practical for development, including: peat coke; activated charcoal from peat; peat as an energy source for use in cement kilns and industrial boilers; and peat for oil absorption.

In western Canada, primarily in Alberta, instability of the industry in the 1970s meant that peat moss exports to the western United States became unreliable. Accordingly, the American market switched to substitute products such as shredded bark, straw and other fibrous material. These products were less expensive and supply was reliable.

Now that the industry is stabilizing in the west (although the number of individual producers is very small), it must try to reattract its old market - both for horticultural peat moss and special mixes, and for new or rejuvenated markets which would use peat moss for purposes other than horticultural applications.

The producers in Canada's peat industry are suffering from common, shared problems: over-production and the need for alternative products, improved marketing and improvements to the system and the costs of product distribution. Producers Associations are emerging to provide a forum in which these problems might be discussed and solutions found.

- Universities

Canadian universities could have an interesting and valuable role in carrying out independent research of regional importance on virtually every aspect of peat and peatlands. This potential is not being realized, although there are pockets of research activity in universities across the country. A wide variety of disciplines are involved, and include researchers from departments of Biology, Geography, Forestry, Agriculture, Engineering and Chemistry plus multidisciplinary programs such as Environmental Studies, Resource Management and Planning.

Several areas of current university research activity may be identified. Basic research includes investigation of:

- ecosystem analysis (i.e. geochemical studies, vegetation structure, peatland morphology and development)
- palynology and paleoecology
- hydrology
- peat chemistry

This research has been funded mainly by the National Science and Engineering Research Council (NSERC) grants program. More recently, researchers have become involved in investigating practical issues and implications arising from peatland development. This research has included such areas as:

- environmental impact assessment
- peatland forestry
- reclamation of developed peatlands
- peat processing and product development
- thermal properties of peat

The growing interest in peat among university researchers offers the opportunity for developing strong centres of research expertise on a regional basis. There are already a number of examples to draw upon:

- MEMORIAL UNIVERSITY in Newfoundland is involved in fuel peat studies and has participated in CREDA projects
- UNIVERSITY OF MONCTON - SHIPPEGAN CAMPUS in New Brunswick is involved in horticultural peat studies
- UNIVERSITY OF SHERBROOKE in Quebec is involved in chemical engineering peat-related activities
- MCGILL UNIVERSITY in Quebec is involved in analysis of sub-Arctic peat environments and peatland geochemistry and peat biochemistry
- UNIVERSITY OF ALBERTA is involved in peatland geochemistry; studies to determine patterns of peatland formation and in peatland forestry studies.

- Consultants

The recent increased government interest and activity in peat research and development has fostered the expansion of private industry expertise in this field. Consulting firms - primarily survey, resource and environmental management and engineering consultants - have become active in virtually every aspect of peat R&D and resource development. Their involvement has included peatland inventories and resource assessment; peat harvesting and site design and preparation; equipment manufacturing; processing research and product development, environmental impact assessment and policy formulation.

The federal and provincial governments are virtually the sole source of contracts and the recent, rapid growth in this "service sector" has been in direct response to the research requirements of the NEP-Peat Program. Prior to the Peat Program, there was very little opportunity or necessity for the private sector to become involved in peat. By contrast, the horticultural peat moss industry itself has not been a factor in encouraging the growth of the service sector.

- **Conservation/Environmental Groups**

In Canada there are conservation groups at the local, provincial, federal and international levels which are dedicated to preserving wildlife and their habitats. Peatland preservation is acknowledged by most of these groups as being part of their general goal of nature conservation. However, it is not at the present time generally considered to be a particularly significant issue. Preservation of peatlands is perceived as a part of the issue of wetland preservation and has therefore occurred mainly as a coincidental consequence of the protection of wetlands in general.

Most conservation groups solicit funds from private and corporate sources. They also accept land donations. Some groups actively purchase land to ensure its conservation. The main purpose of other groups is to educate the public, lobby the federal or provincial governments to preserve areas for wildlife, and/or provide a means for members to share their appreciation of nature.

The Nature Conservancy of Canada identifies wetland preservation as one of its priorities and includes peatlands in this goal. The Canadian Wildlife Federation and Canadian Nature Federation have had limited involvement in peatland conservation.

At the provincial level, the Federation of Ontario Naturalists is widely recognized as committed to wetland (including peatland) preservation.

IV INTERNATIONAL EXPERIENCE

A. Overview

North Americans are relative new-comers to the study and utilization of peatlands. In Europe, peatlands have been utilized for centuries, and are considered to be a major component of the natural resource base of several central and northern European nations, including W. Germany and Finland, as well as in the United Kingdom and Ireland. This chapter summarizes the major activities and issues facing peat management use and development in several American states plus England, Ireland, Scotland, Finland, Sweden, W. Germany and the Netherlands, with an emphasis on lessons and implications for Canadian approaches.

The most prominent uses of peatlands have been in the areas of agriculture and forestry as well as the extractive industries - the horticultural peat-moss industry and fuel-peat development. These traditional peatland uses continue today with the aid of sophisticated management and development techniques which have served to greatly expand the land resource base of a country, particularly for agricultural and forestry capabilities. Peatlands have also provided an economically-viable domestic fuel resource.

In Europe, both the public and private sectors are active in peatland research and development as well as peatland management. Private industry has been particularly active in the horticultural peat moss industry and in fuel-peat development. Government activities are coordinated through national or state departments or agencies responsible for agriculture, forestry and energy. In general, there is no single agency with the responsibility of coordinating activities in all the applicable resource sectors. Although peatlands may be used for several purposes in a given country, there has historically been only one prominent use of the resource. This is now changing with the increased interest and modernization of the fuel peat industry. Also, because of increased development pressure and the intensive forms of development practised, peat land use conflicts are beginning to arise, not only amongst the traditional uses but also between development uses and wetland/peatland conservation.

The emphasis on peatland uses as well as research and development interests and requirements vary considerably throughout Europe, as do the means by which programs and development strategies are implemented. The different countries display a wide range of experience in managing peatlands as well as a great variation in the motivation of their governments to support peat research and development (R&D) activities.

On the North American continent, the experiences of the States of Minnesota and Maine in developing their peat policies and programs are of particular interest to Canada. These states have not had a long history of peat development, and in fact experience less pressure from development than the main peat moss-producing regions of Canada. While seeing the potential for both large and small-scale projects, these states have also recognized the need to incorporate environmental and multiple-use components into their evaluation, development and management strategies. There has also been considerable interaction amongst the federal, state and local levels of government in establishing peat programs and policies. The programs have not yet been tested on a practical basis in terms of wide scale development, but both states will soon have fuel-peat projects underway.

B. Sectoral Experiences

It appears that the most influential policies affecting peat R&D and peatland development have been the National Energy Policies of the respective countries. These policies, which encourage greater dependence on domestic fuel resources have led to the development of fuel-peat industries and a wide variety of technically-oriented R&D activities. This has been the case in Ireland, Finland and, most recently Sweden. Scotland has an interest in developing a small-scale fuel-peat industry based on its traditional use of the resource. However, since the United Kingdom does not include peat in its national energy program, the fledgling Scottish peat industry is finding itself in a precarious situation with an uncertain future.

The horticultural peat industry has traditionally grown through the efforts of private enterprise. This is particularly true of the industry in Europe as there has been considerable interaction between the technologies that are used in the two industries (fuel-peat and horticultural peat), particularly in Ireland, Finland and Sweden where both industries operate concurrently, although the fuel-peat industry dominates.

Agriculture constitutes the most traditional use of peatlands in Europe. Economic necessities, rather than government incentives, have led to many innovations in this area of land-use, both on virgin peatlands as well as in reclamation following peat extraction. W. Germany, the Netherlands and England are the leaders in the agricultural development of peatlands and - due to the ever increasing demands of very large populations on very small land areas - these countries are now investigating the best methods of improving yields on lands which are already very intensively used. Ireland is leading the investigations of peatland reclamation using agricultural techniques.

Forestry is also a major use of peatlands in Europe and takes two general forms: the management of forests occurring naturally on peatlands (such as in Finland and Sweden), and the afforestation of peatlands (as in Ireland and Scotland). Research efforts in this area are in direct response to government policies to improve forestry yields, to regenerate forests, or to develop first-generation forests on land considered to be otherwise unproductive.

Nature conservation and protection is the most controversial issue involving peatlands in Europe. Those countries with the longest history of peatland use are the most severely affected by this controversy. W. Germany and the Netherlands are currently experiencing very strong pressures from conservationists and the issue has become highly political and emotional. Two West German states, Niedersachsen (Lower Saxony) and Bayern (Bavaria) have introduced peatland conservation or protection legislation. England now has an active program to acquire and preserve all undeveloped peatlands. The Irish government and its peat industry are also under pressure to ensure the protection of representative areas of peatlands, but the situation is less critical than on the European continent and has so far avoided the sensationalism being expressed there (particularly in Germany). One positive aspect of this pressure is the increased level of cooperation developing amongst the various research, development and interest groups involved in peat (although with some hesitation and suspicion on the side of the producers). General public awareness of peatlands has increased considerably due to these conservationist movements. However, a basic widespread understanding of peatlands - their ecology, their role in the landscape, and the implications of their use - is lacking. This makes it difficult to resolve the conflicts amongst those responsible for public policy and those who depend on peatlands for their livelihood (especially farmers and horticultural peat-moss producers).

Conservationist pressures have also led to a new area of peat research - peatland regeneration - which offers great potential for an entirely new field of peatland management and peatland ecology.

Countries with a shorter history of peat utilization, such as Sweden and Finland, are not yet experiencing pressure for conservation and protection. These concepts have already been included in integrated peatland utilization plans and limits have been set on the amount and areal extent of peat which may be excavated for fuel purposes or converted to managed forests. Conservation areas have already been established, prior to development, so that sensitive or interesting regions are not threatened by the growing industry.

C. Coordinating Organizations

Following is a brief description of the Canadian chapters of two international organizations which have been established to coordinate information exchange on the topic of peat-related research activities.

Canadian National Committee - International Peat Society - is one of 14 national committees which comprise the international peat community. The CNC-IPS membership is drawn from the Canadian peat community in general. Members receive all NEP-Peat Program-sponsored publications and other relevant information from the IPS. CNC-IPS has organized jointly with other sponsoring agencies four Canadian peat symposia. The CNC-IPS provides a liaison between the Canadian and International peat communities. The committee does not hold general meetings and the Executive meet formally at Canadian Symposia. There are no provincial or regional chapters. The Committee is involved in organizing and promoting research-related activities.

The International Energy Agency - Canada is an active member of a newly-formed sub-committee to enhance international exchange of information concerning the research and development of peat for energy. The sub-committee, established in February, 1984, is composed of four member countries: Sweden, Finland, Ireland, and Canada. This group will concern itself with five research areas, including:

- improvement of milled and sod peat production - Finland, Ireland and Sweden will participate in investigations; Ireland and Finland will be responsible for the presentation of results

- new technology in peat dewatering - Canada, Finland and Sweden will participate; Sweden will be responsible for the presentation of results

- basic research in peat dewatering - Canada, Sweden and (to a lesser extent) Finland will participate; Canada will be responsible for reporting

- peat classification and standardization - all four countries will participate; Sweden will be responsible for reporting

- information exchange - Ireland (Bord na Mona) will be responsible for this activity

The first stage will be to present a state-of-the-art report on these five research areas and to make recommendations on international cooperation in these areas. The work should be presented by mid-1985.

V ISSUES, CONCERNS AND RECOMMENDATIONS

Although the primary focus of this report is on Research and Development, the consultants have noted relevant conclusions and recommendations related to the broader aspects of policy development and coordination. Similarly, although this study was funded through federal programs, it is national in scope - addressing issues, and concerns in the federal, provincial, private and international sectors.

The issues, concerns and recommendations identified represent the views of the consultants and are not necessarily those of the federal government.

This chapter highlights issues, concerns and recommendations in the following areas:

- Policies and Legislation
- Coordination and Communication
- Research and Development
- International Involvement
- Training and Education.

A. Policies and Legislation

1) Federal Level

Since 1982, the Peat for Energy and Chemicals Program (Peat Program), within the National Energy Program, has been providing direct support for peat energy-related activities at the federal level. Although the Peat Program has succeeded in coordinating the peat-related activities of a variety of federal departments and has given peat-related issues a higher profile, it has focused on energy-related research and development and is scheduled to complete its first phase in 1987.

While the NEP Peat Program is currently the only federal program specifically and directly related to peat, some existing federal policies could potentially influence peat and peatlands. These included the National Land Use Policy as well as individual departmental policies concerning energy, land use, wetland conservation, agriculture and forestry. However, because there is a lack of recognition of peat as a significant national resource, some of these policies are not as yet applied to peat and peatlands. Others are only indirectly or partially applied.

Experience in other countries has shown that research and development into the use and applications of peat and peatlands progresses with greater consistency when supported by official policies and well-defined strategies and goals. Examples include forestry policies in Finland, the U.K. and Ireland; agricultural development policies in Ireland; new policies and legislation regarding wetland conservation in Germany; and national wetland policies, particularly in Ireland, Finland and Sweden, but also in the United States and Canada. National energy policies have been instrumental in encouraging the development of organized peat R&D strategies in Ireland, Finland and Sweden.

- A national peat policy framework or strategy is needed to guide the development and/or application of specific policies to peat issues. This policy framework should address implications of: the regional aspect of the resource; its multiple use nature and the distinct nature of peatlands as a form of wetlands (much in the same way that marshes and swamps have been accorded special interest) in order to provide an integrated peat resource management policy. The potential international role for Canada in marketing peat research and development technology should also be addressed in a policy framework.

- Federal departments with interests in peat and peatlands should establish on-going peat strategies and programs as part of their "A-Base" (i.e. permanent program not dependent on contributions from other funding departments or agencies). These programs should operate under the broad umbrella of the above-recommended national peat strategy or policy framework.

- Broad interdepartmental policies such as the National Land Use Policy should be more specifically adapted and applied to the unique and special characteristics of peatlands.

ii) Provincial Level

All provinces have legislation which provides a general framework for peat utilization, either through their mining or their agricultural statutes. However, there is little provincial legislation which properly addresses the unique and special characteristics of peatlands which provide a minable non-renewable resource, a natural ecosystem and lands for renewable resource utilization requiring special protection.

- Existing provincial legislation should be modified to include guidelines regarding requirement of a drainage, mining and rehabilitation plan, as well as ditching and mining techniques. Also, existing legislation preventing the interference of ponds, brooks and streams or requiring the conservation of topsoil may need to be modified to allow peat mining to occur.

Most provinces have land use policies and some have policies related to energy. However, peat is frequently not included in these policies. Part of the reason for this oversight may be the low profile peat has held as a consequence of the lack of distinction of peatlands as a special wetland type. Peatlands are also not well recognized as a resource and have rarely been included in provincial natural resource inventories. Further, some resource surveys that have included peat have been biased toward specific resource sectors, e.g. the energy potential of the resource, horticultural peatmoss, wildlife habitat, etc. to the exclusion of other uses.

- Provincial resource management policies for peat development and peatland use are required to ensure that the multiple use nature of peatlands is recognized and the wisest use is made of peatlands.

The provinces of Ontario, Newfoundland and New Brunswick have a peatland coordinator or coordinating committee to facilitate communication among departments which are involved in peat activities. A Peat Technical Working Group also exists which coordinates communication of provincial government peat initiatives related to fuel-peat interests among the provinces.

- All provinces which have a variety of departments involved in peat activities should consider establishment of an interdepartmental committee to provide coordination and communication of these activities.

B. Coordination and Communication

Coordination of peat and peatland research and development activities has proven particularly difficult in view of the enormous array of federal and provincial government departments and their various agencies which are currently active in, or with potential to become involved in, peat and peatland investigations. These include at least 17 federal and 32 provincial government agencies with varying levels of responsibility and involvement in peat. In addition, there are eight established working groups, committees and societies in Canada which directly or indirectly address the issues of peat and peatlands.

The federal government Peat Program has provided an effective beginning to the coordination of peat R&D. However, its jurisdiction is restricted to federal activities. Furthermore, its activities are limited to one resource sector - energy - although other sectors (notably agriculture and forestry) derive certain benefits from research being carried out within the Peat Program framework.

At the committee, society and working-group level, there is no single vehicle, either nationally or provincially, which has both the broad sectoral jurisdiction and the capacity to encourage and influence future direction in peat and peat-related R&D.

- A national advisory committee or working group should be established to direct future developments in peat Research and Development, through the identification of research requirements in the various sectors which incorporate peat and peatlands, and through the promotion of these research needs. The regional uniqueness and development potential of peatlands should be considered in establishing such a group. This favours regional or provincial chapters with a membership drawn from a broad base, including federal and provincial government participants, universities and private industry.

Currently established groups could be examined for possible expansion of their mandate to incorporate this responsibility. A survey of the current CNC-IPS membership could be undertaken to provide an indication of the potential support for such an advisory group.

C. Research and Development

1) Peatlands as a Resource

Those sectors for which peat and peatlands are currently being examined or used for their resource potential include horticulture, agriculture, forestry, energy and industrial chemicals. The recent activities in fuel peat research and development, at both the federal and provincial level, have resulted in a considerably higher profile for peat than previously experienced. They have also led to more diverse investigations in other sectors, primarily agriculture (which constitutes a potential land reclamation strategy for mined peatlands), and have encouraged peat resource inventories in a number of provinces. This heightened interest is a direct result of national and provincial energy policies. However, the provinces in particular have recently tempered their interest in fuel peat potential from a previously high level between 1981 and 1983.

A decline in interest in the fuel-peat sector could have an effect on interest in peat research in general. It has been largely through this high-profile sector that a greater awareness of the resource potential of peatlands, outside the traditional peat community research, was established. Although peat and peatlands are currently used as a resource in other applications, principally the horticultural industry, agriculture, and less noticeably in berry production, and are now being studied for more intensive management in forestry, peat and peatlands are not widely recognized for their resource potential, except by those most directly involved with them.

In order to encourage sustained research interest and activity in peat, it will be necessary to establish peat and peatlands as an acknowledged resource and resource environment in Canada. However, there is considerable speculation concerning the actual importance of peat and peatlands in the country and there is very little precise information concerning their actual use or use potential.

Neither the provinces nor the federal government have an adequate assessment of the geographic extent of useable peat resources, nor do they have reliable data on peatlands currently being developed, the purposes for which they are used, and their current and potential contribution to the national or provincial economies. Specific information concerning bio-physical/climatic constraints to development or the socio-economic and environmental benefit/impact considerations is almost totally lacking. Such information is necessary to provide the background with which peat and peatland concerns can be incorporated into relevent programs, policies and resource development and management strategies.

- An assessment of the actual resource potential of peatlands, incorporating the requirements of applicable resource sectors, should be carried out. Such an assessment would need to consider the regional uniqueness and development potential of peatlands and should address the following: the geographic extent and nature of peatlands currently under production or development in Canada; the extent and nature of peatlands suitable for future development based on bio-physical, climatic and socio-economic factors; the current contribution of peatland-derived products and/or employment to local, regional, provincial or national economies.

ii) Technology Transfer

In Canada and especially in other countries with a long history of peat mining and use, much has been learned about the physical properties of peat, different techniques for mining and processing the resource for different purposes, and effective strategies and processes for conservation and reclamation. The problem is that the knowledge which has been developed to date has not been widely disseminated to potential users. In the absence of a concerted and coordinated strategy for the transfer, dissemination and adaptation of international knowledge and experience for Canadian industrial purposes, there is a tendency to unnecessarily replicate the mistakes of the past in searching for suitable mining, processing, reclamation and conservation technologies for Canada.

A certain amount of technology transfer is now occurring at the R&D phase, particularly in the energy sector with Canadian participation in the new Peat Sub-Committee of the International Energy Agency. Technology transfer in forest drainage is also being implemented between Canada and Finland and interest is also being shown in acquiring greater knowledge of agricultural management practices of peatlands.

- Such transfer incentives should be encouraged to develop further and to broaden into the industrial sector as there is considerable scope for growth in this respect.

- A coordinated and comprehensive strategy for peat technology transfer should be developed, giving priority consideration to those resource sectors and geographic areas demonstrating greatest opportunities for development. The strategy should address opportunities for on-going information exchange and communication as well as support for technological training and orientation programs for potential resource developers and users.

iii) Sectoral Research

a) Energy

Technology for the development of fuel-peat in Canada is being investigated and tested through the current R&D activities of the Peat Program, as well as the recent projects carried out under the Conservation and Renewable Energy Demonstration Agreements (CREDA). However, it will be necessary to establish the actual feasibility of a fuel peat industry in Canada before this resource sector can be expected to evolve into a viable industry.

- Research should be carried out to establish the feasibility of a viable fuel-peat industry in Canada or selected regions. This should identify the appropriate geographic locations for fuel peat development (based on not only the resource availability) but also environmental (particularly climate) and socio-economic suitability.
- A comparison between fuel peat development and other forms of energy development (taking into account energy cost subsidization) should be completed in order to determine the relative viability of energy from fuel peat.

b) Agriculture

Peatlands, along with other wetlands, are used for agricultural production across the country. Research is being carried out to improve the agricultural capability of organic soils, to select crops best suited for production on organic soils and to solve problems (e.g. subsidence) which are of particular importance to these soils. However, in order that organic soils gain wider recognition as a component of the national soil resource, more information will be required on the geographic extent of the agricultural capability of peatlands. A thorough assessment of the current and potential economic contribution of products and employment derived from peatland agriculture would also be valuable in determining the degree to which peatland development may be a partial solution to Canada's agricultural challenges (e.g. as noted in the recent Senate Committee Report Soils at Risk).

- A comprehensive assessment of the agricultural potential of peatlands should be carried out, including an estimate of the current and potential future economic benefits of the development of appropriate peatlands for agriculture.

c) Forestry

To date, interest in peatland forestry and the management of forested peatlands has not been a great concern in Canadian forestry, although some attention is now being given to the development of silvicultural techniques in forested peatlands in boreal regions. However, there is very little information concerning the extent of forested peatlands in Canada, their resource potential, and the annual yields. As conventional forests across the country experience greater harvesting pressures, more attention will be directed toward less easily accessible forest environments such as peatlands.

- Research regarding the forestry potential of peatlands should be undertaken to provide information required for assessing and managing the forestry resource in the future.

d) Horticulture

The horticultural peat moss industry is the only commercially viable peat industry in Canada. This industry is currently experiencing marketing problems which are resulting from such problems as overproduction, high transportation costs, a lack of product diversity and competition from substitute products. The industry tends to be conservative. Innovative products derived from peat, which are in great demand in Europe, do not appear to be a major factor in influencing product development in Canada. (Consumer demand is probably not as sophisticated in North America as in Europe, and greenhouse horticulture and domestic gardening are far more intensive in Europe.) Quality control of products is not universal amongst Canadian peat moss producers, nor are the established standards for Canadian products.

The horticultural peat moss industry is experiencing a shift from the previous emphasis on small and medium-scale, family owned operations to large scale, sophisticated, domestic or internationally owned companies. Because of the large discrepency between these two groups in production and R&D capacity, two tiers of competition are developing and a new relationship between these two groups will have to evolve if the small producers can be expected to survive.

- Research should be undertaken to increase product diversity and broaden the uses and applications for horticultural peat.
- Research into the development of quality control techniques and appropriate quality standards for Canadian peat should be undertaken.
- Research should be carried out on the structure of the Canadian peat industry, and options for transportation, distribution and marketing in Canada and abroad.

This research could be undertaken by the private sector, with potential government support for research of universal benefit to all producers, especially smaller and fledgling firms with reasonable growth prospects.

e) Industrial/Chemical

Research is being carried out on the chemical properties and potential uses of peat and related by-products. In the industrial and chemicals sector, there are numerous commercial products which could potentially be derived from peat. The problem is that little has been done in Canada to develop, test and operationalize commerically-viable production processes for different peat products.

- Intensification of research into the uses, applications and appropriate production processes of chemicals from peat is required if the industry is to develop.
- Research into areas in which peat-derived products could be economically substituted, thereby freeing other feedstocks e.g. coal and other hydrocarbons, for uses in other industries should be undertaken.

f) Environmental Conservation

Although some basic research concerning peatland environments has been in progress over a number of years in universities, and more recently in government programs (primarily through the Canadian Forestry Service), there is still a very poor understanding of the role of peatlands in the natural landscape. Investigations concerning the necessity of peatland conservation, or uses of a conserving nature- particularly in those regions where peatland development is occurring - have been virtually neglected in federal and provincial peat-oriented programs and studies. Many argue that the issue is included with wetland conservation. However, wetland conservation is itself receiving only scant serious consideration. Although guidelines for wetland conservation have been developed and will be used by several provinces, there is no legislation which would enforce wetland protection.

Although 90% of wetlands are considered to be peatlands, the greatest attention is directed toward other wetland types, primarily marshes and swamps. These areas are important waterfowl habitats, whereas peatlands are non-productive in terms of waterfowl. Certain agencies which actively promote the conservation of marshes and swamps in aid of waterfowl management also advocate the "conversion" of peatlands, through flooding, to wetlands more productive of waterfowl. This is a valid "in-situ" peatland use but also contradicts the goal of wetland conservation as applied to peatlands.

Currently identified peatland uses do not reflect the growing concern for wetland conservation. Greater emphasis is now being placed on waterfowl habitat management. Conservation is of paramount concern to ensure this use. When drained and converted to agricultural lands, this use potential is destroyed. On the other hand, agriculture, forestry, horticultural and fuel peat development and even flooding for waterfowl management are considered to be important peatland uses. Conservation is not accorded much importance, nor has it been examined as a potential "use" of peatland environments.

- Further research to determine the ecological importance of peatlands (e.g. for hydrological and wildlife benefits) should be undertaken.

- Research should be directed toward establishing criteria for peatland conservation, recognizing the importance of assessing the suitability of conservation in comparison with all other established and potential uses.

- "Uses" which take advantage of the natural condition of peatlands should be examined in greater detail, and should be considered for incorporation into peatland conservation strategies.

D. International Involvement

Canada is an active member of the international peat community and while much of the work carried out by peat researchers has a low profile nationally, it enjoys high visibility in an international context. Canadian peatlands are a great source of interest for researchers and developers in Europe. The relatively undeveloped state of Canadian peatlands is the major factor, both for those interested in studying undisturbed peatland environments, as well as those looking for opportunities to expand their production capability and take advantage of the North American market (particularly for horticultural peat moss).

Canada's recent development of fuel-peat technology has also increased its capacity for technology exchange with other countries. For example, Canada is becoming a leader in developing dewatering technology, which has the potential of becoming an exportable technology to Europe and perhaps also to the United States. Developing nations are also showing an interest in fuel-peat development, and several countries are currently pursuing the fuel-peat energy options. Canada could have a major role in providing expertise to interested nations. Based on the current multi-disciplinary approach of fuel-peat energy research, Canada could have an important role in advocating environmentally responsible development by aiding in the development of mining and processing techniques which incorporate environmental abatement technologies. Planning for future reclamation strategies is additional expertise which Canada could offer.

Canada's vast areas of undisturbed peatlands are a source of considerable research interest in Europe, particularly in view of the strength with which peatland conservation interests are developing overseas. Peatland conservation is also being investigated in the United States, particularly in Maine and Minnesota.

- Canada should explore the future importance of its international involvement in peat research and development by:
    - examining Canada's responsibility to the international research community, particularly in the areas of environmental research and nature conservation

- assessing the ability of Canada to advise, when requested, on peat resource development in developing countries not only in fuel-peat, but also in agriculture, forestry and environmental conservation

- investigating the potential for foreign investment in peat-based industries in Canada and the desirability of supporting domestic development with the intent of supplying European or other off-shore markets

E. Training and Education

The potential of universities to contribute to all aspects of peat studies has been overlooked in many regions of the country. Universities provide a unique opportunity for research which is unbiased and which is not hampered by the recurrent problem in resource-related issues of whether a project should be a federal or provincial responsibility. The results of such work are of value to both levels of government.

Universities, with integrated programs such as resource and land-use management programs, environmental studies programs, etc. have already adopted a multidisciplinary approach to studying resource related problems. These approaches are particularly well suited to the study of peat and peatlands. University research staff are also, in general, familiar with the geographical region in which their university is located. In addition - and particularly where repetitive field work is concerned - students can be employed in such a way that field sessions could be considered a part of their research training. This might also increase the awareness and interest in the topic which has been lacking at the university level.

Currently, very little graduate research is being encouraged on the subject of peat despite the fact that there are numerous peat-related topics which would be appropriate for graduate research and which would help to enlarge the basic knowledge of peatlands in any given region.

- Universities and related funding institutions should more actively pursue research and education on the subject of peat, with an emphasis on addressing local and regional issues and opportunities (including specific research needs of industry and government).

- To encourage greater university participation, government agencies should consider increased interaction with university researchers, either where an interest in peat and peatlands already exists in that university, or where the location of the university warrants fostering of additional regional expertise in peat and peatland research.

Volume

2

National Research Council Canada
Conseil national de recherches Canada

Division of Energy
Division de l'énergie

Peat Energy Program
Programme d'énergie de la tourbe

PEAT POLICIES AND ACTIVITIES IN CANADA.
VOLUME II: DETAILS

J. Phillip Nicholson Policy and
Management Consultants Inc. (Ottawa)

December 1984

[illegible]

This report summarizes work carried out under contract to the Division of Energy, National Research Council of Canada. It has been published in its original form, in keeping with the policy of the National Research Council of Canada of making information on energy research and development available to all interested groups. Publication by the National Research Council of Canada does not signify that the contents necessarily reflect the views or policies of the National Research Council of Canada, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. Furthermore, no warranty or representation is made with respect to the accuracy or completeness of the information contained in this report. This report is reproduced here from camera-ready copy prepared by the contractor.

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PEAT POLICIES AND ACTIVITES IN CANADA.
VOLUME II: DETAILS

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EXECUTIVE SUMMARY

J. Phillip Nicholson Policy and Management Consultants Inc. (Ottawa) have produced a two volume report, Peat Policies and Activities in Canada, in response to an unsolicited proposal which identified the need for an assessment of the current status and organization of peat research and development in Canada.

The information and recommendations contained in the report are designed to assist policy makers and program coordinators in defining future directions for peat-related research and development in Canada. The report is also intended to be of use and interest to individuals and agencies in both the public and private sectors who are either actively involved in peat activities or who have an interest in peatlands and peat resources in Canada.

The results of the study are presented in two volumes, Volume I: Highlights and Volume II: Details.

Volume I: Highlights focuses on the current major themes and interests in peat research and development in Canada and abroad. More specifically, Volume I provides an introduction to peatlands which outlines the nature and extent of Canadian peatlands as well as their historical use and recent research interests. An overview of the interests, concerns and experiences of other countries involved in peatland development is also provided.

The major portion of Volume I is devoted to a national overview of current Canadian peat issues, interests and activities in the private and public sectors as well as a review of key policies, programs, legislation and coordinating activities of the federal and provincial governments which are of relevance to peat research, development and management in Canada.

Finally, Volume I provides recommendations in the areas of policies and legislation (at both the federal and provincial level); coordination and communication; research and development; international involvement; and training and education to aid in the further development and evolution of peat programs and activities in Canada.

Volume II: Details presents detailed information on the organization, objectives and nature of peat and peatland activities being carried out in the various agencies of the federal and provincial governments, as well as the private sector in Canada. It also presents the major programs, activities and research directions of seven European countries and several states in the United States. This is followed by Appendices, including a presentation of the current legislation and policies of particular relevance to peat research and development in Canada. The contents of this detailed volume form the basis upon which the highlights, conclusions and recommendations contained in Volume I: Highlights have been formulated.

RÉSUMÉ ADMINISTRATIF

La société J. Phillip Nicholson Policy Management Consultants Inc. (Ottawa) a produit un rapport en deux volumes intitulé, Peat Policies and Activities in Canada, en réponse à une proposition non sollicitée qui identifiait le besoin de faire une évaluation de l'état actuel et de l'organisation de la recherche et du développement sur la tourbe au Canada.

L'information et les recommandations contenues dans le rapport sont conçues pour aider les responsables de l'élaboration de politiques et les coordonnateurs de programmes à définir les orientations futures de la recherche et du développement reliés à la tourbe au Canada. Le rapport est également destiné à éveiller l'intérêt d'individus et d'organismes, tant dans le secteur public que privé, qui participent activement à des activités reliées à la tourbe ou qui s'intéressent aux tourbières et aux ressources provenant de la tourbe au Canada, et à leur être utile.

Les résultats de l'étude sont présentés en deux volumes, nommément: Volume I: Highlights et Volume II: Details.

Le Volume I intitulé Highlights fait le point sur les principaux thèmes et intérêts courants de la recherche et du développement dans le domaine de la tourbe au Canada et à l'étranger. Plus précisement, le Volume I renferme une introduction aux tourbières dans laquelle sont tracées les grandes lignes de la nature et l'étendue des tourbières canadiennes et de leur utilité historique ainsi que des intérêts, des préoccupations et de l'expérience d'autres pays engagés dans le développement des tourbières.

La plus grande partie du Volume I est consacrée à une vue d'ensemble, à l'échelle nationale, portant sur les questions, les activités et les intérêts canadiens courants au chapitre de la tourbe dans les secteurs public et privé et passe en revue les politiques, les programmes, les lois et les activités coordonnatrices clés des gouvernements fédéral et provinciaux ayant rapport avec la recherche, le développement et la gestion de la tourbe au Canada.

Finalement, le Volume I contient des recommandations au chapitre des politiques et de la législation (à la fois aux niveaux fédéral et provincial); de la coordination et des communications; de la recherche et du développement; de la participation internationale; et de la formation et de l'éducation, lesquelles visent à contribuer au développement futur et à l'évolution des activités et des programmes reliés à la tourbe mis en oeuvre au Canada.

Le Volume II intitulé Details présente des informations détaillées sur l'organisation, les objectifs et la nature des activités ayant rapport à la tourbe et aux tourbières qui sont réalisées au sein des divers organismes des gouvernements fédéral et provinciaux et du secteur privé au Canada. Il décrit en outre les principaux programmes et les principales activités et orientations de la recherche dans sept pays européens et dans plusieurs états américains. Viennent ensuite les annexes, ainsi qu'une présentation sur la législation et les politiques courantes se rapportant particulièrement à la recherche et au développement reliés à la tourbe au Canada. Le contenu de ce volume détaillé constitue la base sur laquelle sont fondés les conclusions, les recommandations et les faits saillants contenus dans le Volume I: Highlights.

I THE REPORT

A. Purpose and Use

This is the second volume of a two-volume report which presents the observations, conclusions and recommendations of a study which has been prepared for the Government of Canada Peat for Energy and Chemicals Program managed by the National Research Council. The study was undertaken by the firm J. Phillip Nicholson Policy & Management Consultants Inc. (Ottawa), and was initiated in response to an unsolicited proposal through the Unsolicited Proposal Program of Supply and Services Canada. The project proposal identified the need for an assessment of the current status and organization of peat research and development (R&D) in Canada.

The study has been directed toward all resource sectors in which peat or peatlands have a role, and has concentrated in particular on the following:

- areas of concern and interest in relation to peat resources and peat research and development
- organization and coordination of peat-related R&D activities
- policies and legislation of particular relevance to peat R&D

The report is intended to be of use and interest to individuals and agencies in both the public and private sectors who are either actively involved in peat activities or who have an interest in peatlands and peat resources in Canada. The information and recommendations contained in the report are designed to assist policy makers and program coordinators in defining future directions for peat-related research and development in Canada.

B. Methodology

The project was carried out from January to December, 1984. During this time, six months were devoted to collecting the information on which the observations, conclusions and recommendations of this report are based. This information was collected through:

- bibliographical and literature research, including Canadian and international sources
- a legal assessment of the legislation pertaining to peat development in Canada

- extensive personal interviews and/or written communication with over 100 individuals in federal and provincial government agencies, private industry, universities and private special interest groups and organizations in Canada and the United States
- personal interviews with more than 30 individuals in government and private organizations in Ireland, England, Scotland, Finland, Sweden, the Netherlands and W. Germany

Information requirements were further supplemented by attendance at the International Peat Symposium in Dublin, Ireland (June, 1984) and through the contributions of associates in London, England. In a further effort to reach as many potential contributors as possible, the project was publicized through an article in the Environment Canada Lands Directorate newsletter LAND/TERRE, Vol. 5, No. 1, 1984 (edited by Nicholson Consultants). Responses to this article from more than a dozen different organizations were incorporated in the report.

In preparing this final report, which includes conclusions and recommendations for future R&D policies and programs, the consultants have also drawn on their extensive experience in environmental and resource-management fields, as well as policy and program development for more than 30 different federal departments and agencies over the past twelve years.

C. Contents

The results of the study are presented in two volumes:

Peat Policies and Activities in Canada

- Volume I: Highlights
- Volume II: Details

VOLUME I: HIGHLIGHTS, summarizes the current major themes and interests in peat research and development in Canada and abroad, and presents a series of recommendations intended to aid in the further development and evolution of peat programs and activities in Canada.

VOLUME II: DETAILS presents detailed information on the organization, objectives and nature of peat and peatland activities being carried out in the various agencies of the federal and provincial governments, and the private sector in Canada. It also presents the major programs, activities and research directions of seven European countries and several states in the United States. This is followed by Appendices, including a presentation of the current legislation and policies of particular relevance to peat research and development in Canada. The contents of this detailed volume form the basis upon which the highlights, conclusions and recommendations contained in VOLUME I: HIGHLIGHTS were formulated.

The contents of Volume II are organized as follows:

The Federal Government, including:

- a description of major federal peat-related policies, programs and activities of several key federal departments and agencies

The Provincial Covernments, including:

- a description of the major peat-related policies, programs and activities of each of the ten provinces, and of key departments and agencies within each province

The Private Sector, including:

- a description of current activities and concerns of peat-dependent industries in Canada
- a summary of interests and selected major projects currently being pursued in peat research in universities across Canada
- a summary of peat-related expertise developed by consultants
- a summary of peat-related concerns and activities of conservation groups

The International Experience, including:

a presentation of the various approaches being taken by seven European countries and several American states in peat research and development and peatland management

II THE FEDERAL GOVERNMENT

A. Introduction

Individual federal departments do not have policies which specifically address peat. However peat and peatland research activities have been undertaken within related ongoing programs of the departments, e.g. research in the land use capability for organic soils undertaken as part of the activities of Agriculture Canada's Soil Classification Research Group; wetlands (including peatlands) have been studied by the Lands Directorate as part of their Ecological Land Classification program.

As a result of the inclusion of a separate Peat for Energy and Chemicals Program within the National Energy Program, peat-related R&D activities have also recently been undertaken in areas beyond ongoing internal department programs.

This chapter describes the interdepartmental policies and programs (e.g. NEP Peat Program), the peat-related activities of federal government departments, and federal/provincial initiatives.

B. Interdepartmental Policies and Programs

i) Peat Initiatives Within the National Energy Program

When the National Energy Program (NEP) was announced in October 1980 it stressed the goal of Canadian crude-oil self-sufficiency by 1990 through the development of indigenous fuel resources. The various alternative energy options referred to in this program are known collectively as the "off-oil" policies.[1]

Conservative estimates indicate that Canada's peat resources have an energy reserve potential of 100 billion tons, which places Canada's peat reserves in the same order of magnitude as those of coal, oil and gas.[2] The development and use of peat as an energy alternative would thus be in keeping with the "off-oil" policies of the NEP.

Developing the peat resource presents a number of problems. Raw peat is approximately 96 per cent liquid and thus offers innumerable technical and logistical challenges associated with its extraction (or mining), transportation, processing and utilization. In Canada, these problems are compounded by geographical factors. With the exception of Atlantic Canada, the most extensive peat areas generally occur in the northern regions of the provinces and the territories and, consequently, in regions where both the climatic factors and low population density have made development of the resource unattractive.

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[1] Energy, Mines and Resources Canada, The National Energy Program (Ottawa: Department of Supply and Services, 1980) p. 54.

[2] Tibbetts, T. "A Peat Program - Planning for Canada's Future" in J. Collins, ed. A Peat Research Directoryfor Canada (Ottawa: Peat Forum, 1982) p. 6.

The climate in most of the major peat regions of Canada is characterized by cool, short summers with high and/or frequent precipitation. Such factors encourage the growth of peatlands, but severely restrict the use while increasing the cost of traditional peat mining methods which rely on natural drying (air and sun) techniques. Even if the technical difficulties of mining were to be overcome, the fuel must still be transported considerable distances to major markets. The very high volume-to-weight ratio of this bulky product results in prohibitive transportation costs. Moreover, at the outset of the NEP there was very little information available on the amount, or areal extent of peatlands in the country; the location of the peat reserves most suited to energy exploitation; or the most reliable means of obtaining an accurate survey in a country covered by an estimated 120-150 million hectares of peat. The technologies for this development, i.e. the specialized harvesting equipment, transportation, storage and burning facilities, were not available in Canada, nor was it known to what extent foreign technologies (e.g. Finland, Ireland and the U.S.S.R.) could be successfully implemented in Canada.

In order to pursue the option of using peat as an energy source, the National Energy Program (NEP)-Peat for Energy and Chemicals Program (Peat Program) was established as part of the NEP in fiscal year 1982-83. The Peat Program, which is managed by the National Research Council of Canada, is one of six programs organized under Task 4 - Renewable Energy of the NEP. Funds are allocated to the Peat Program via the Interdepartmental Panel on Energy Research and Development, chaired by the Department of Energy, Mines and Resources (EMR), The Peat Program is organized into six sub-programs:

- resource inventory
- mining
- dewatering/processing
- environment
- product development and standardization
- and program management.

Within the above sub-programs are a number of projects which are being implemented under the direction of various government agencies, including the National Research Council; Environment Canada (Environmental Protection Service and Canadian Forestry Service); and Agriculture Canada (Land-Resource Research Institute). Some projects are conducted by in-house resources while others are sub-contracted to other government agencies or private industry.

The organization and description of the Peat Program is shown in Figure 1: Peat for Energy and Chemicals Program ("Peat Program").

FIGURE 1: PEAT FOR ENERGY & CHEMICALS PROGRAM ("PEAT PROGRAM")[3]

Sub-Program	Program Objectives	Responsible Agency
4.6.1 Resource Inventory	develop inventory technology and a first-level inventory for the evaluation of peat in the context of land use competition and environmental considerations	1) Agriculture Canada - Land Resource Research Institute 2) Environment Canada - Canadian Forestry Service
4.6.2 Mining	conduct basic research and development of peat mining and harvesting technologies required to bring peatlands into production; improvements to mobility on peatlands and minimization of environmental impact during peatland development	1) National Research Council - Energy Division
4.6.3 Dewatering/Processing	investigate the means of dewatering peat through drainage and thermal/mechanical/chemical processing; develop methods for in-situ utilization of peat; participation in joint medium and large-scale chemical and gas production ventures	1) National Research Council - Energy Division
4.6.4 Environment	develop environmental protection criteria and pollution abatement technologies; develop reclamation strategies for post-development utilization	1) Environment Canada - Environmental Protection Service 2) Agriculture Canada - Land Resource Research Institute

FIGURE 1: PEAT FOR ENERGY & CHEMICALS PROGRAM ("PEAT PROGRAM") (cont'd)

Sub-Program	Program Objectives	Responsible Agency
4.6.5 Product Development and Standardization	develop and test new methods of characterizing and developing peat; examine other potential uses of peat in addition to energy production; investigate technologies for the conversion of raw peat to a higher grade fuel, e.g. carbonization or gasification; transfer peat science into viable industrial processes	1) National Research Council - Energy Division
4.6.6 Program Management and International Activities	organization of overall program infrastructure; international participation through the Canadian National Committee of the International Peat Society	1) National Research Council - Energy Division

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3 EMR Office of Energy R&D, Federal Energy Research and Development Plan (Ottawa: D.S.S., 1983), pp. 4-3, 4-4, 4-57, 4-58.

The inclusion of a separate Peat Program within the NEP and the commitment of $11 million over a 5-year period (1982/83 to 1987/88) to peat research and development has provided a very positive incentive for developing specific peat-oriented technologies. The objective is to develop a sound technological base for fuel peat in Canada and to achieve a level of technical capability in this field which is demonstrated by Canada's counterparts in Europe.

Appreciating that success is more likely if attention is directed toward developing suitable technologies for peat development in remote regions (primarily northern regions), the federal Peat Program is currently directing its research to developing the technology for large scale wet-mining projects. Wet-mining is a simpler method than dry-mining since it requires less site preparation and therefore far less time before the site is ready for production. Production results from wet-mining are almost immediate, compared to dry-mining methods. But most importantly, wet-mining is independent of weather conditions - a factor which has made it a particularly attractive alternative for fuel peat development in northern Canadian environments. The major technical problem concerns removing the water from the peat slurry to yield a solid-fuel product. Both the technical and environmental aspects of this process are receiving considerable attention in the Peat Program.

ii) Federal Policy on Land Use

In April, 1981, the Minister of the Environment released the "Federal Policy on Land Use." The policy is very general in nature and open to broad interpretation. There are, however, several aspects of the policy which could have a direct or indirect impact on wetlands, including peatlands.

The first of the two policy statements which could have direct application to wetlands addresses the issue of conservation and preservation:

> The federal government will identify and, as appropriate, protect through designation or acquisition, lands of particular value to the nation because of historical, cultural, recreational, aesthetic or ecological importance.
>
> Programs that deal specifically with these lands are being carried out within the Department of Indian and Northern Affairs and the Department of the Environment.
>
> Representative samples of Canada's natural landscapes, seascapes and ecosystems are acquired and maintained through the National Parks Act.
>
> Under the Historical Sites and Monuments Act, sites of historical and cultural value to the nation are preserved and, as required, acquired by the federal government.
>
> The Territorial Lands Act is used in the Territories to set aside lands of particular value such as game sanctuaries and national forests. Federal/provincial/territorial agreements under the Agreements for Recreation and Conservation Program identify and protect lands considered to be important recreational resources.
>
> Under the Canadian Wildlife Act and Migratory Birds Convention Act, wildlife areas and sanctuaries are designated and acquired.

The programs referred to in this statement would probably include the Wetland Evaluation Program being carried out by the Canadian Wildlife Service (CWS). The emphasis of the Wetland Evaluation Program is on marshes, and peatlands are considered to be of little value under this program. Furthermore, the Department has little direct involvement in wetlands in general or peatlands in particular.

Several National Parks do contain peatlands. This has, however, been largely through a coincidence of location rather than a mandate to preserve peatlands. Guidelines are not available which could be used to evaluate the suitability of a peatland for conservation. Peatland conservation is not largely recognized as a National Parks issue at this moment, and peatlands are accorded little value as natural areas in Canada.

The second policy statement which could have direct application to wetlands is oriented toward land-management and land-use.

> The federal government will provide a coordinated program of surveys and socio-economic, scientific and technical research on land capability, characteristics, tenure and use.
>
> Surveys and research in the fields of:
>
> - geological surveys
> - topographic mapping
> - soils
> - ecological mapping
> - social, economic and environmental aspects of land use
> - identification of critical lands
> - land-use monitoring
> - forest inventories
> - water surveys
> - collection of socio-economic data relating to land use
>
> are key elements in the formulation of sound land-management strategies by all who influence the use of land.

The wetland component of Environment Canada's Canada Land Use Monitoring Program (CLUMP) could be considered as part of the surveys and research being carried out in land-use monitoring. The Environment Canada's Lands Directorate activities in the National Wetlands Working Group can be identified as a component of surveys and research in ecological mapping. Forest inventory research has extended to encompass activities in peatland inventory methodology. The Organic Soils Program, the Peatland Reclamation Program and the Peatland Inventory Methodology studies of the Land Resource Research Institute of Agriculture Canada contribute to survey and research in the field of soils. They include the following:

> The impact of policies and programs on watersheds, aquifers, recharge and storage areas, and other lands critical to the quality and quantity of the nation's water supply will be considered. Appropriate action will be taken to ensure their protection.
>
> The impact of policies and programs on lands which are of particular value because of historical, cultural, recreational, aesthetic or ecological importance will be considered and appropriate action will be taken to preserve or enhance their value as a national heritage.
>
> The impact of policies and programs on fragile and critical habitats will be considered and appropriate action will be taken to prevent unnecessary damage to such lands.

These guidelines are conservation-oriented. Since conservation is currently not largely recognized as a vital issue regarding peatlands, the impact of these guidelines is limited.

Other guidelines could be relevant when the resource applications of peatlands are considered, particularly peatland agriculture, forestry and fuel peat development.

> The impact of policies and programs on land with high agricultural capacity will be considered. Appropriate action will be taken to minimize the conversion of such lands to uses incompatible with long-term food production.
>
> The impact of policies and programs on land with high forestry capacity will be considered. Appropriate action will be taken to ensure the maintenance of such lands for sustained fibre production.
>
> The impact of policies and programs on the use and development of lands with potential for production of non-renewable resources such as minerals, hydrocarbons and aggregates will be considered. Appropriate action will be taken to ensure access and, where required, rehabilitation.

Peatlands in Canada, unlike mineral soils, have not yet been classified according to their agricultural capability. According to the Canada Land-Use Classification, peatlands and other wetlands are identified as organic soils and are not accorded a land-use value. However, some peat areas have already proven their high agricultural capacity. This would suggest that other peatlands might have the same potential. Criteria are not yet available to determine the agricultural capacity of a peatland so that it is currently not possible to apply this policy guideline in protecting peatlands threatened by urban growth or other "incompatible uses." The same can be said for the forestry capacity of peatlands. Their capacity must be rated on a different basis than forest environments on mineral soil. Until these criteria are available, it would be difficult to implement these federal land use policy guidelines should the need arise.

Criteria are available to assess the potential of an area for fuel peat development. The question of rehabilitation after peat is extracted is particularly challenging when a peatland has been destroyed and the peat deposit removed, many rehabilitation options are available, but all entail a land-use very different from the original environment. Criteria are not yet available to aid in selecting appropriate rehabilitation approaches, and provincial statutes are vague about what rehabilitation for peatlands should entail.

C. Agency Activities

i) National Research Council

The peat R&D activities of the National Research Council are organized under the following Peat Program sub-programs:

- Mining
- Dewatering and Processing
- Product Development and Standardization.

These projects are managed through the Energy Division and include both in-house projects and projects being carried out on contract by independent researchers (universities, private research facilities, engineering consultants, etc.). The mining and dewatering and processing research is now concentrating on projects closely associated with wet-mining and the pre-treatment and processing of peat slurries.

There are two in-house projects operating within the sub-programs; they are: 1. Peat Processing and Product Development and 2. Peat Standards and Testing. These projects began in fiscal year 1983/84 and will operate until the end of the Program in 1987/88.

1. Peat Processing and Product Development

The objective of this research is to develop an energy-efficient process for the thermal pre-treatment of peat slurries which improves upon the currently available wet-carbonization processes. A peat slurry is the product of the wet mining process, a process which is receiving considerable attention because of a variety of presumed advantages it offers when compared to conventional milled or sod peat production techniques. These advantages include the following:

- Wet mining can be carried out independent of weather conditions, thus potentially extending the mining season to a full 12 months annually.

- Wet mining does not require that a bog be drained prior to development, thus production can begin immediately after removing the surface material without waiting 2-3 years for drainage to be completed.

- Production yields are easier to control and can be predicted with reasonable accuracy since they are not dependent on weather conditions, thus delivery of the products may be guaranteed and over-production can be avoided, thereby eliminating the need for costly storage facilities.

- Since the peat is not dried on the bog surface, wet mining eliminates the danger of dust-fires, environmental hazards and loss of mineral product.

The commercial success of wet-mining technology is, however, dependent on the economical processing of an energy efficient product. This requires the development of reliable, "artificial" drying techniques - techniques which are not dependent on solar radiation for drying. Such techniques must remove enough water from the fuel-grade peat to allow either efficient combustion of the solid fuel or further processing.

Mechanical dewatering systems depend on either a belt or filter press, and can be both energy efficient and mechanically simple. However, due to the colloidal nature of raw fuel peat, the systems have not been successful in achieving moisture contents below 70 per cent. It is generally assumed that, in order for the colloidal mechanical dewatering process to be effective, the material which comprises fuel peat must first be broken down.

Pre-treatment processes can include freeze-thawing, chemical addition, mechanical shear and heating. The general term given to heating peat slurries to 180°C or higher is known as the thermal pre-treatment process.

This process is known to have a number of proven advantages. For example, thermally pre-treated peat can be mechanically dewatered to water contents of 50 per cent or less; it can be pelletized or upgraded to other carbon products and the process does not appear to be dependant on peat quality.

The main concern is the energy efficiency of the thermal pre-treatment process. Improvement in energy efficiency is necessary if this process is to become commercially viable. To achieve this objective the Peat Processing and Product Development Project has been designed to conduct the following research:

- investigate the heat transfer characteristics of peat slurries (and design and construct a heat exchanger for efficient pre-heating and thermal pre-treatment of peat)

- investigate the reaction kinetics of the thermal pre-treatment process

- study the rheology of high temperature peat slurries (up to 220°C)

- characterize the dewatering characteristics of thermally pre-treated peat solids

- characterize the chemical and fuel value of thermally pre-treated peat solids

- characterize the solid fraction from the waste-water stream produced after dewatering the thermally pre-treated material and determine potential treatment and utilization alternatives of the organic fraction - most probably through fermentation

- investigate methods of further upgrading the thermally pre-treated, dewatered peat to a denser fuel or alternative carbon products

The body of information to be acquired on this pre-treatment process will provide the capability to assess the merits and efficiencies of currently existing available systems. It is also intended that enough information and experience will be gained by fiscal year 1985/86 in order to design an integrated wet mining/peat processing/production facility which could be constructed on a pilot scale and in operation during fiscal year 1986/87 and 1987/88.

2. Peat Standards and Testing

The objectives of this in-house project are to develop standards and testing techniques which will allow quantitative characterization of peat and peat products, particularly fuel peat. There is currently no standard agreement within Canada on routine test-methodologies for fuel-grade peat. Most laboratories apply either the guidelines provided in the NRC Peat Testing Manual (Technical Memorandum No. 125) prepared by the Associate Committee on Geotechnical Research or the ASTM Standard for Coal and Coke. Since neither of these guidelines have specific relevance to fuel-grade peat, this requires that each laboratory must adopt its own sample preparation and testing procedures or modify those provided in the above manuals.

In order to produce a set of standard testing procedures and product standards for fuel peat, the research project incorporates the following studies:

- comparison and evaluation of existing test methodologies for the analysis of fuel-grade peat - including proximate (moisture, ash, fixed carbon, volatiles) and ultimate analysis, calorific value, humification, bulk density and particle size analysis

- development of new or modified test methodologies and product standards, where required, in conjunction with commercial and government labs and international standards committees

- preparation of standard peat samples for use in comparison testing between labs

- investigation of the effects of sample preparation and thus particle size distribution on the reacting peat samples (heat transfer characteristics)

ii) Environment Canada

It is difficult to assess the official stance which Environment Canada takes on peatlands. This must, in part, be attributed to the very complex nature of peatlands regarding both their uses and the question of their classification. There are no internally-funded programs within Environment Canada which deal specifically with peat or peatlands. However, these lands are studied within the context of numerous programs and projects in various Branches and Services, according to the different environments (e.g. forests, wetlands) with which these programs are concerned.

Where environmental aspects of development are the primary issue, the Environmental Protection Service (EPS) and the National Water Research Institute are actively involved. If peatlands are regarded as wetlands, then the Lands Directorate and the Canadian Wildlife Service have been active, to varying degrees and with varying interests. The Canadian Forestry Service is interested in many aspects of peatland forestry.

This chapter describes Environment Canada's peat-related activities under seven headings: Environmental Protection Service; National Water Research Institute; Lands Directorate; Canadian Wildlife Service; Parks Canada; Canadian Forestry Service; Environment Canada Policies Regarding Peat R&D.

1. Environmental Protection Service (EPS)

The Environmental Protection Service of Environment Canada has the responsibility for coordinating and managing a series of projects under the Environment sub-program of the NEP Peat Program. These projects comprise the "Pollution Control at Source" environmental protection aspects of developing peat for energy. As such, they define, in part, the objectives of the Environment sub-program to develop environmental protection criteria and pollution abatement technologies for peat harvesting and processing techniques.

The technical and administrative responsibilities for this research are organized through EPS - Atlantic Region office in Halifax. Much of the work is awarded on contract to other government agencies, (previously to the National Water Research Institute - Environmental Conservation Service, in Burlington Ontario) or to academic and private research institutes, environmental consultants and consulting engineers. The Atlantic Region office also provides on-going coordination with the NRC - Atlantic Research Laboratory and with provincial regulatory and natural resources agencies in Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland and the State of Maine.

The Mining, Minerals and Metallurgical Processes Division, Industrial Programs Branch at Environment Canada's Head Office in Hull, Québec provides technical expertise by way of representation on Peat Forum. The Branch also provides EPS - Head Office and Divisional representation on the Peat Environmental Committee and is involved in coordinating activities amongst various Federal Departments (Energy, Mines and Resources; Environment Canada; National Research Council; Agriculture Canada) and activities within Environment Canada itself, including the Canadian Forestry Service (CFS), the Canadian Wildlife Service (CWS), the Environmental Protection Service (EPS), the Environmental Conservation Service (ECS), the Lands Directorate and the department's regional offices.

The EPS first became involved in peatland development when the Atlantic Region office expressed concern over the potential impact of horticultural peat mining in the Maritimes on water quality. This concern led to the submission of two proposals to the newly-formed NEP-Peat Program to study the environmental impact of the peat mining industry.

During the first two years of the EPS-Program,(fiscal year 1981/82 and 1982/83), funding was allocated from the NEP via the Program for Energy Research and Development (PERD)-Peat Forum-NRC route. As of fiscal year 1983/84, funding has been allocated directly from the Peat Program Funds to EPS.

The research has been concerned with establishing baseline information on peat and peatwater chemistry, studying the effects of peat mining (with particular emphasis on wet mining techniques), and predicting the impact of development on various ecological parameters. The intent is to establish a set of pollution-abatement standards which would ensure that surface and ground water systems, wetlands ecology and air quality are not damaged through the release of pollutants from facilities that would mine, process or utilize peat for energy production.

Research projects have been established to achieve the following:

- characterize the water chemistry of undisturbed peatlands and to study the changes which occur in receiving streams during the various stages of development

- establish the environmental and ecological sensitivity of peatlands to development and the effects of pollution

- identify and characterize potential organic and inorganic contaminants in both the peat solids and peat water which could be released upon development

- identify and characterize potential contaminants which could be released with the solid, liquid or gaseous wastes of mining, pre-treatment, processing, combustion or conversion activities

- identify and develop environmental protection criteria which would be applied to various stages of peat development

- identify the appropriate pollution-abatement technologies which would be used in the mining, processing, combustion and/or conversion stages

The research work is being carried out both in-house and on contract. It has consisted of literature reviews, peat-site sampling programs, waste-product sampling and testing programs. Many of these projects are running concurrently. Information has now been collected and is available on the current understanding regarding peat and peatland chemistry and peatland sensitivity to development. This provides the starting point from which baseline data from a variety of Canadian peatlands would be collected.

A major problem to date has been the lack of suitable test sites, particularly for monitoring fuel peat development. Although many of the same techniques for fuel peat development are applied in bog preparation for horticultural peat development, the sites in Canada currently under production were not sampled prior to development. Baseline data comparing pre- and post-development are therefore not available. The on-again, off-again nature of the recent fuel peat demonstration projects has also made establishing a reliable, long-term sampling program difficult. The opportunities currently look promising, however, for a comparitive sampling program which could be set up within the next year at Barrington Bog in Shelbourne County, Nova Scotia. This site is being investigated for fuel peat demonstration development, and the study would provide very valuable information on the changes which a peat land experiences through the various stages of surface preparation, drainage, mining and on-site utilization. The project would be a cooperative effort between the federal and provincial agencies.

Difficulties are also encountered in acquiring pre-treatment and processing waste samples. What is provided must come mainly from bench-scale equipment, due to the lack of pilot or operational scale facilities in Canada.

2. National Water Research Institute (NWRI)

The National Water Research Institute (NWRI) is currently conducting a sampling program to characterize bog and receiving water chemistry both prior to and during mining activities. The sampling program began in fiscal year 1983/84 at various horticultural peat sites across the country and was carried out on behalf of EPS to provide baseline information for the "Pollution Control at Source" research program. The NWRI sampling project is now receiving funds directly from the NEP-Peat Program through the Program for Energy Research and Development (PERD). However, the EPS and NWRI research activities will continue to be closely coordinated and will be directed towards the "Pollution Control at Source" aspects of the peat mining and dewatering processes.

The previously mentioned Barrington Bog development (see EPS, above) will be the major component of the NWRI sampling activities. The first stage of this sampling project began in 1984 at Barrington Bog in anticipation of future development.

3. Lands Directorate

The Lands Directorate regards peatlands as wetlands and, as such, they are studied within the context of three Lands Directorate Programs:

- Ecological Land Survey (ELS) Research Program
- Long Range Transport of Airborne Pollution (LRTAP) Program
- Canada Land Use Monitoring Program (CLUMP)

The ELS program is a part of the work carried out under the Canada Committee on Ecological Land Use Classification (CCELC). The wetland concerns of this Program are integrated with the activities of the National Wetlands Working Group. The Lands Directorate provides a secretariat for CCELC and publishes some of the work resulting from the committee, including Wetlands of Canada (1981) - a folio of maps on Wetlands Regions and Wetlands Distribution.

LRTAP research is concerned with mapping the potential sensitivity of terrestrial ecosystems to the effects of acid precipitation. Wetlands are being investigated as part of a major research project being carried out by the Lands Directorate in cooperation with the National Water Research Institute (NWRI). The purpose of the project is twofold:

- develop a model of the role of wetlands in airborne pollution cycling
- evaluate the components of wetland systems most sensitive to acid precipitation ("acid rain")

The Lands Directorate's main wetlands research program began in 1983 as part of the Canada Land Use Monitoring Program - CLUMP. CLUMP itself was initiated in 1978 in response to a cabinet directive to develop a program for monitoring land use change in Canada. CLUMP activities are organized into five areas:

- Prime Resource Lands
- Urban-Centred Regions

- Rural Areas
- Wildlands
- Program Development

Wetlands are one of three elements currently included in the Prime Resource Lands category; the other two being Prime Fruitlands, and Framework Development (to develop future studies for forest lands, energy resource lands and resource conflict areas). Prime Wetlands research focuses on wetlands as an area of national concern, placing particular emphasis on the loss of wetlands, or wetland conversion, in southern Canada. Studies have been carried out in-house and on contract to produce the following:

- national overview of existing wetland data bases, current research and approaches to studying wetland changes

- series of maps showing the extent of wetland losses in Southern Ontario in a historical context by establishing 1) the original areal extent of wetlands prior to settlement, 2) the area of wetlands converted between settlement and 1965, 3) wetland conversions from 1965 to 1975,) and 4) a series of maps showing wetland conversion as a result of urbanization using "Urban-Centred Regions"

- computer mapping technique for monitoring wetland conversion across Canada based on the results from the Southern Ontario development project (a similar technique is also planned for Urban-Centred Regions)

- Projects are also planned which will a) look at changes occurring on federally managed wetlands - particularly threatened wetlands in Migratory Bird Sanctuaries, National Wildlife Areas and National Parks and b) monitor current land-use change in wetland regions. It is intended that by 1985, this program will produce a set of studies which can identify wetland conversion trends across the country.

4. Canadian Wildlife Service

The Canadian Wildlife Service (CWS) has very little involvement in peatlands, although it has a special interest in other wetlands. For the CWS, marshes are considered special wetlands. Their importance as valuable waterfowl habitats has long been a key interest of the CWS and most of the Service's activities in wetlands research have been concentrated on salt- and fresh-water marshes. Peatlands have been of little interest to CWS.

Since 1981, the CWS has been operating an internally-funded Wetland Evaluation Program. The purpose of the program is to map wetland areas - including peatlands (where they exhibit waterfowl habitat characteristics) - according to their value as wildlife habitats. Of particular interest is the value of such areas as waterfowl habitats. The program is organized through CWS regional offices and is conducted in cooperation with provincial wildlife agencies. The maritime provinces and Ontario are currently being evaluated.

The first, or "pilot", mapping project was carried out in Nova Scotia and Prince Edward Island. All fresh and saltwater wetlands over 0.25 hectares in size were included in the inventory. A New Brunswick wetland mapping project has recently commenced (fiscal year 1983/84). The province of Ontario began its own evaluation program during fiscal year 1983/84, using an evaluation system developed in cooperation with CWS, which provided technical assistance and expertise during the three-year evolutionary process. Québec is not yet involved in the mapping program, nor will the system be applied in the near future in the western provinces. Newfoundland is not being included in the project since its wetlands are primarily peatlands - bogs - and are of little importance as waterfowl habitat.

CWS is also represented on the board of Wildlife Habitat Canada, an independent foundation partially supported by federal grants and loans, whose purpose is to buy land in order to preserve habitat of importance. Wetlands, including peatlands, are one of the foundation's priorities.

5. Parks Canada

National Parks are designed to protect for all time representative natural areas of Canadian significance in a system of national parks, and to encourage public understanding, appreciation, and enjoyment of this natural heritage so as to leave it unimpaired for future generations.[4]

Currently, five national parks contain peatlands:

- Kouchibagouac, New Brunswick
- Gros Morne, Newfoundland
- Terra Nova, Newfoundland
- Wood Buffalo, Alberta and the Northwest Territories
- Prince Albert, Saskatchewan

Kouchibagouac contains 4,500 hectares of peatlands and provides an interpretation centre and boardwalk into the centre of one of its peat bogs.

Parks Canada has developed a systems planning procedure for determining how many parks it will establish and where they will be established. Using this method, Parks Canada has divided the country into 48 natural regions; 39 terrestrial and 9 marine regions. Within each of these regions Natural Areas of Canadian Significance are identified. One is eventually chosen (following consultation and agreement with the respective province) to be a national park.

Parks Canada does not focus on any single feature of an area when choosing the site for a national park. Instead an area is chosen which encompasses as many themes found in the region as adequately as possible.

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[4] Environment Canada, Parks Canada Policy (Ottawa: Department of Supply and Services, 1982) p. 11.

In three of the eleven terrestrial regions presently without national parks, peatlands dominate the landscape. Accordingly, it is possible that a national park could be established which would contain peatlands in one or more of the following regions:

- 23 - The Whale River region, Nouveau Quebec;
- 27 - the Hudson James Lowlands region;
- 14 - the Manitoba Lowlands region.

Region 20, the Laurentian Boreal Highlands and Region 22, the Boreal Lake Plateau (both located in Quebec) are also areas which contain peatlands.

While National Parks do contribute to the conservation of natural areas, this is not their only, nor major, purpose. Both active and passive recreational activities are encouraged in the parks.

6. Canadian Forestry Service (CFS)

The Canadian Forestry Service (CFS) mandate does not establish a specific responsibility for studying peat as a resource. The CFS does, however, have limited involvement in peat-related research arising from the general responsibility to conduct research in aid of forest management - including forest management on peatlands.

Peat and peat-related projects are currently underway at three CFS establishments:

- Northern Forest Research Centre (NFRC) in Edmonton
- Great Lakes Forest Research Centre (GLFRC) in Sault Ste. Marie
- Newfoundland Forest Research Centre (NFRC) in St. John's.

The studies managed at the Great Lakes Forest Research Centre are funded internally and are being carried out in cooperation with various agencies of the Ontario Ministry of Natural Resources (OMNR). The studies are part of two larger projects, the first being a GLFRC internal program on Black Spruce Ecosystems and the second an OMNR-Northern Region study on Operational Forest Drainage in Peatland Black Spruce Stands.

Peat and peat-related projects at the Northern Forest Research Centre and the Newfoundland Forest Research Centre have developed both in connection with internal programs and in response to the NEP-Peat Program. The NEP-Peat Program projects are being carried out in connection with the Resource Inventory sub-program and will continue for the duration of the Peat Program. Although the projects consist predominantly of in-house research, a number of contract studies assessing the extent of the peat resource have been managed under these projects.

a. Northern Forest Research Centre

Peat-related studies are carried out under the Environmental Impact Assessment and Peatland Ecology project. This project began in 1981 prior to funding from the Program for Energy Research and Development (PERD). PERD funding has since been made available for field expenses and lab analysis of field samples; CFS funds cover person years and salaries.

The original intent was to investigate the environmental impact of land development - primarily energy and transportation related development - on terrestial ecosystems in northern Canada, and to develop criteria to help minimize this impact. Peatlands are extensive and commonly-occurring ecosystems in northern regions. Thus, they would certainly be affected by the pressures of development in these areas. However, since very little is known about peatland ecology or peatland development it became necessary to expand the project, and to include peatland studies as a major project component.

In addition to the project objectives related to general environmental impact asessment and mitigation measures, a third objective, very specific to peat, is also included:

- determine the ecology of peatland development within the region and develop guidelines for peatland management and rehabilitation

This latter objective is being dealt with in a Peatland Development and Ecology Study. The Study is based on an extensive fieldwork program covering western Canada - east of British Columbia - and the Northwest Territories. Once completed, results will be available for a number of detailed investigations of peatlands in the Mackenzie River valley and the boreal regions, including topographical and vegetation surveys, peat coring and sampling and laboratory analysis of physical and chemical properties, pollen analysis and dating. The long-term goal of this project, as it relates to peat, is to provide an ecologically sound basis for peatland development.

b. Great Lakes Forest Research Centre

In Ontario, 46 percent of black-spruce dominated forests occur on peatlands. Forested peatlands present their own special problems and require special management practices which are not directly transferrable from methods used on mineral soils. Management techniques for forested peatlands are poorly-developed in Canada. Peatland studies are an integral component of the

Black Spruce Ecosystem Silviculture Project which has been in operation since 1981-82 at the Great Lakes Forest Research Centre. Component Studies of this project which relate directly or indirectly to peatlands include the following:

- Site classification: to develop a Forest Ecosystem Classification as a framework for accumulating information on productivity, regeneration and site treatments; to serve as a tool for forest management practices in various ecosystems and to develop a Wetland Classification for the Clay Belt Region of Ontario.

- Intensive Management: to compare natural productivity to that of drained and fertilized sites in order to determine the extent to which drainage of black spruce peatlands would be economically feasible. Such drainage techniques are being studied as a primary management technique for this ecosystem type.

- Peatland Regeneration and Forestry: to improve the knowledge of successful regeneration techniques on cut-over peatlands, including site preparation, seed bed requirements and forest and site conditions influencing advanced growth in black spruce peatlands; the effects of logging on the rate of advanced growth; measures for preserving advanced growth and regrowth in cut-over peatlands.

- Modified Harvesting Techniques: to research the regeneration rates of seedlings in strip cuts in comparison to clear cuts in both peatland and upland sites.

- Seeding and Site Preparation: to develop techniques which improve regeneration capabilities of a site, paying particular attention to seed bed preparation, mechanical scarification and prescribed burning.

Two other studies are underway and are being carried out in cooperation with Ontario government agencies. The first involves a peatland inventory program; the second a peatland drainage experiment.

The Peatland Inventory project is a joint study involving the GLFRC, Ontario Centre for Remote Sensing, Ontario Geological Survey and the Ontario Ministry of Natural Resources - Northern Region. The objectives of the study are twofold:

- develop an integrated peatland inventory methodology and colour composite peatland maps using computer-enhanced satellite image interpretation. and helicopter-assisted ground truthing
- develop for Ontario, a refined second approximation of the hierarchy (or tiered) wetland (including peatland) classification methodology, identifying wetlands according to their physiognomic and vegetation characteristics.

This inventory is being developed using the Clay Belt Region of Ontario. Colour composite satellite maps have been produced at scales of 1:50,000, 1:100,000 and 1:250,000 and are currently being used by the OGS to aid in their site selection for the detailed Peat Inventory Program now underway in the province.

The most recent project, the Peatland Drainage Experiment, was introduced during fiscal year 1984-85. It is managed jointly by the GLFRC and the Ontario Ministry of Natural Resources. It is part of a larger program on operational forest drainage being implemented by the Ontario Ministry of Natural Resources - Northern Region. Intensive drainage management is being applied at a number of peatland sites to evaluate the feasibility of using this method of peatland forestry management in northern Ontario. A major component of this study is technology transfer - from Finland to Canada. A Finnish consultant is responsible for introducting the forest drainage techniques which have been used successfully in Finland to an experimental setting in northeastern Ontario. The intent is to draw on the knowledge and experience gained over many years in Finland, thus bringing peatland drainage techniques in Canada up to a higher technical.

c. Newfoundland Forest Research Centre (NFRC)

In Newfoundland, wetlands (primarily peatlands) are one of three dominant vegetation types - the other two being forests and heaths. The NFRC has been involved to a limited extent in peatland studies since 1975, within the context of the on-going NFRC project Forest and Plant Ecology. This project has had the following long-term objectives:

- complete forest, heath and wetland classifications for Newfoundland and Labrador and use these classifications in forestry, agriculture and wildlife management

- establish an ecological data bank of wetlands for purposes of conservation and multiple use with local, national and international applications

- provide basic ecological information on the major tree and shrub species of Newfoundland for use in forest management

- gain a better understanding of the pedologic factors that control forest productivity and use this information to aid in site management

Eleven studies are being carried out within the Forest and Plant Ecology project, three of which have been designed specifically for the study of wetlands (or peatlands):

- Multiple Use Potentials of Wetlands
- Wetlands - National and International Activities (CCELC)
- Ecological Investigation of the Afforestation Potential of Peatlands.

Several other studies have peatland components including: Ecology of Newfoundland soils; Ecoregions of Canada; and Thematic Mapping for Forest Management in Newfoundland.

Recently, much of the peatlands-oriented research of the Forest and Plant Ecology project has been carried out under the NEP-Peat Program as part of the Resource Inventory sub-program. The project, "The Classification and Ecology of Wetlands in Labrador and Problem Wetland Areas of Western Newfoundland and the Maritimes" became part of the NRC-Peat Program from 1981 to 1983-84, thus continuing work by the CFS which has been ongoing since 1976. The original objective was to determine if peatlands could be developed for forestry purposes. This evolved into a multiple-use peatland classification system for Newfoundland. The study was carried out in-house and funded through the CFS up to fiscal year 1981-82 with the following objectives:

- classify the wetlands of Labrador
- provide information on the age, development processes and nutrient status of representative peatland types for inclusion in the Wetland Registry and the Wetlands of Canada book
- study the origin and ecology of representative wetland types in Labrador
- sample wetland types in problem areas of Nova Scotia, New Brunswick and Western Newfoundland

The Newfoundland-Labrador wetlands classification is also a part of the overall National Wetlands Working Group program.

Another series of projects also carried out under the auspices of the NEP Peat Program and completed as of March 1984, include:

- application of the Landsat Thematic Peatland Mapping Program (Applicon Mapping System) of the Ontario Centre for Remote Sensing to 12 peatland areas in Newfoundland and Labrador, producing 12 colour composite maps at a scale of 1:50,000

Internal funds are now being directed toward the research and development of peatland forestry in central Newfoundland, corresponding to the study Ecological Investigation of the Afforestation Potential of Peatlands.

Unlike many of the northern peatlands of mainland Canada, Newfoundland bogs are not forested. This new project will be concerned with the following:

- determining why trees do not grow naturally on Newfoundland peatlands;

- investigating techniques used in the afforestation of peatlands, including drainage, fertility, species selection, seeding techniques, and machinery;

- establishing study sites on bogs and fens (in northwestern Newfoundland) and applying the various techniques in an on-going research effort.

7. Environment Canada Policies Regarding Peat R&D

Although actively involved in numerous projects of relevance to peat and peatlands, Environment Canada has not, as yet, established definite policies or objectives which define its role in peat R&D.

Although the Department has not defined its own wetlands policy, it has been approached in the past by other agencies to provide expertise in assessing the need to formulate such policies. In 1978, the Department was approached by the Environmental Control Council of Nova Scotia which requested the comments or opinions of Environment Canada regarding the desirability of a formal wetlands policy for the province. The Department established a committee to reply to this request. The committee was composed of the Environmental Protection Service, Fisheries and Marine Service, Canadian Wildlife Service and was chaired by the Lands Directorate. The committee responded with a brief report, outlining federal concerns regarding wetlands. The brief is not a policy statement and, because it is directed toward wetlands in Nova Scotia, it naturally concentrates on points of specific concern for wetlands in maritime regions - particularly salt marshes. However, the following comments contained in the brief do have a broad, general application and appear to be applicable to all wetland environments:

> "Both tidal marshes and upland wetlands are vital to the stability and productivity of the natural environment. It is well documented that wetlands serve as habitat, shelter and sources of food for a wide variety of fish and wildlife species. Many upland wetlands act as water storage areas for flood control and may serve to balance the flow of streams during dry summer months. In addition, wetlands, with their vast diversity of plant and animal life, are ideal for outdoor educational and recreational purposes ...
>
> ... Environment Canada fully recognizes the importance and value of preserving wetlands ...

> ... The Department recognizes the need for coordinated federal and provincial legislation covering wetlands and firmly supports the development of a wetlands policy for the Province (Nova Scotia). One of the most pressing requirements is the need to develop an information system that would illustrate to the general public the value of natural wetlands for the ecological well-being of the Province ...
>
> Wetlands cannot be considered in isolation. Activities on adjacent lands can be very deleterious to the wetlands themselves. Thus, the question of buffer zones arises. Similarily, there are many dyked marginal agriculture lands that may be better utilized if returned to marshlands; this involves the question of conflicting land uses. Such considerations are only examples of the kinds of problems that cannot be solved by the development of a policy or legislation with a single focus. An intergovernmental consultative committee on wetlands is suggested as one way to ensure that all environmental implications are taken into account when considering the future disposition of wetlands in the Province.
>
> The regional elements of the Department of the Environment would support a joint federal/provincial approach to the development of policy, strategy or compatible legislation for the protection of the Province's wetlands ..."[5]

The statements argue strongly in favour of responsible wetland management, stressing integrated use, the importance of wetland conservation and the importance of joint federal-provincial participation in policy development. The Department has not its formally adopted these statements as official policy, although projects such as the CWS - Wetland Evaluation Program and the wetlands component of the Lands Directorate's Canada Land Use Monitoring Program (CLUMP) are in place, and do reflect the basic concerns, principles and interests contained in the statements.

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[5] "Response from Environment Canada to the Environmental Control Council Regarding Nova Scotia Wetlands Policy" in Proceedings of a Workshop on Canadian Wetlands (C.D.A. Rubec and F.C. Pollet, eds. Ottawa: Environment Canada, 1981) pp. 71-72.

An Environment Canada position paper Energy and the Environment - Environment Canada's Strategy (Policy Directorate, Corporate Planning Group January 1983) defines the interests and responsibilities of Environment Canada related to the development of Canada's energy sector. The Department states that its primary role in energy is "to promote and contribute to the development of environmentally-harmonious demand for and production and use of energy." This role encompasses the conclusions put forward in 1980 by the Department's Senior Management Committee which define the Department's responsibility in "the assessment of the impact on the environment of various energy programs and projects, the identification of opportunities for the renewable 'environmental' sources of energy, the provision of environmental information required for the safe and efficient design and operation of energy systems and the promotion of a positive concept of conservation."

In defining the departmental role in energy more thoroughly, the Energy and the Environment document describes the issues and priorities of the Department in energy. These include major projects, the departmental approach to energy issues, its responsibility for energy-related activities and a framework for future actions. The framework is very specific in summarizing the general and specific energy-related projects of the Department. This is done under the headings Energy Source, Responsible Agency and Status. Peat is not included in the Energy Strategy.

Considering that the key issue in peat R&D is currently energy, and that Environment Canada's Environmental Protection Service is a major participant in the NEP Peat Program (organizing and actively engaged in the "Pollution Control at Source" fuel peat research) the omission of peat from the Department's Energy Strategy is a visible gap. If the Energy Strategy were concerned only with convential energy sources, the omission would not be questioned. However, the discussion includes an outline of projects and strategies for coal, biomass and "renewable sources of energy." The omission is therefore unfortunate since the Energy Strategy could otherwise have been the first departmental strategy in which peat would have received recognition as a component of a major resource sector. The Department is involved in a number of different aspects of peatland research and development. The omission of peat in the Energy strategy suggests that peat has a low profile in the department and that the implications for environmental disturbance in fuel peat development are not fully appreciated by those determining the Energy Strategy.

iii) Agriculture Canada

Agriculture Canada is involved in peat and peat related research through the activities of the Land Resource Research Institute (LRRI) and a number of Research Stations throughout the country. The LRRI and the Research Stations are part of the Research Branch of Agriculture Canada.

Land Resource Research Institute (LRRI)

The Land Resource Research Institute (LRRI) has a general mandate to manage and to conserve Canada's land and soil resources and to improve the capability of these resources for agriculture.

To achieve this the Institute requires that a thorough inventory of the soil resource be available and that the soil classification systems which are used both adequately reflect the range of soil types found in the country and may be applied in aid of developing the resource. Until recently, neither of these two requirements were being met adequately for peatlands. This was largely due to the generally low land-use capability assigned to organic soils, with the result that these soils received considerably less attention in the area of land-use management than their mineral soil counterparts. Some research and field activity has been carried out in surveying and classifying organic soils, but this has been done in the general context of the Canada Soil Survey and in developing the Soil Classification for Canada.

Two groups within the LRRI are now carrying out research to investigate ways of improving the land-use capability of peatlands and to develop an inventory methodology for peatlands. The Soil Classification Research Group is responsible for improving the land-use capability of the resource while inventory methodology is the responsibility of the Soil Survey Group. A considerable amount of the peat research currently in progress is being carried out in conjunction with the Peat Program. This Peat Program research is being conducted within two sub-programs:

- Resource Inventory
- Environment

The Institute's research under the auspices of the Peat Program has been motivated by two requirements:

- the need for a reliable, nation-wide inventory of peatlands, particularly if available fuel peat reserves are to be accurately assessed
- the need for viable reclamation strategies for the use of peatlands following extraction development - whether the peat extraction be for fuel, industrial or horticultural purposes.

1. Soil Classification Research Group

This group has been involved in a number of in-house projects which have included investigations of organic soils and the agricultural use of peatlands. It is also involved with the NEP-Peat Program activities.

In-house projects comprise the on-going Organic Soil Program and include the following:

- investigations of the botanical composition of peat to help identify the origin of the peat material and plant microfossils
- rubbed fibre tests to improve humification testing
- studies of special problems in peatland cultivation, particularly sudbsidence in peat soils currently under agricultural production
- preparation of a land-use capability for organic soils

The first two investigations are related to the Peatland Inventory Program of the Soils Survey Group and are being carried out in order to improve the current methods used for peat (organic soil) classification and to improve the methods used for assessing the degree of humification of the peat. This latter objective is also of particular importance in determining the suitability of peat for fuel or horticultural purposes.

Investigation of subsidence in peat soils is being carried out in cooperation with several research stations in the country. Some of the most productive truck farming regions in Canada are underlain by organic soils. These include the Holland Marsh area of southern Ontario, the Fraser River Delta region in southwestern British Columbia and a number of smaller regions in the St. Lawrence Lowlands. Certain areas have experienced severe soil depletion as a result of aeration, drainage, and intensive agricultural practices. They are now facing the problem of reaching mineral soil and in some areas, mineral soil islands are now appearing through the surface of the organic soil. This is particularly noticeable in some of the areas under production in the Fraser River Delta.

Controlling or slowing down the rate of subsidence in peat soils has thus been one of the research efforts of the Institute, and field trials have been carried out at several research stations. The research efforts in this area comply with the mandate of land resource conservancy by developing means of conserving the organic soil resource and prolonging the life of the agricultural regions.

The fourth activity, preparing a land-use capability for organic soils, is currently being carried out in connection with the Peat Program-funded research.

NEP-Peat Program research is concerned with developing strategies for reclaiming cut-over peatlands. Because of the Institute's agricultural concerns, the major emphasis is being placed on agricultural uses, although energy crop production, afforestation and recreation as well as the regeneration of peatlands are other possibilities. The research project is concerned with three essential problems:

- the hydrology of the underlying soil, or sublayer hydrology
- the use of drainage in peatland agriculture
- selecting appropriate cropping systems for harvested peatlands

Much of the work on the sublayer hydrology has been completed during the first two years of the project. Understanding the hydrology of the underlying mineral soil is particularly important for determining whether or not a cut-over area can be cultivated for agriculture. Silt and especially sand offer the best chances for successful cropping. In the next three years, field tests will be developed to investigate drainage methods (ditch spacing and depth), different cropping systems which can be used, prospects for "building" an appropriate agricultural soil by mixing the remaining peat material to different depths in the underlying mineral soil.

Test sites have been or will be established at a number of locations across Canada to investigate the problems involved with the agricultural use of peatlands. In these studies, much of the in-house-sponsored and Peat Program-sponsored work complement each other. The following study sites have been selected:

- the Alfred bog at Caledonia Springs, east of Ottawa, where the hydrological properties of mineral sub-soils are being investigated (contracted to the Department of Geography, Carleton University)

- St. Clothilde, an area in the St. Lawrence lowland region of Quebec currently under cultivation, where different mixing methods, depths of mixing and cultivation over different mineral sub-soil types will be studied

- Shippegan, in northeastern New Brunswick, where extensive horticultural peat operations in this region, offer the opportunity to conduct a number of studies on agricultural productivity on cut-over peatlands

- Kapuskasing in northeastern Ontario, where agricultural production on the shallow organic soils in the clay belt is being investigated

- southeastern Manitoba farming district, southeast of Winnipeg, where some farming and mining has already been carried out on shallow peat soils. One recently approved reclamation project entails the cultivation of wild rice in peatlands (this is currently being investigated in cooperation with the Manitoba Peatland Farmers Association)

- Fraser River Delta, British Columbia, near Richmond - an important peat area currently under cultivation but which is experiencing problems associated with the high sulfur content of the lower peat layers and a clay subsoil which, as the peat depth slowly decreases, (due to depletion) creates problems for continued cultivation

2. Soil Survey Group

Research and development of a National Peat Inventory Methodology subprogram - No. 1 of the NEP-Peat Program is the responsibility of the Soil Survey Group. The objectives of this research program, entitled the Peatland Inventory Program are to:

- develop guidelines for a standardized Peatland Inventory Methodology
- evaluate the national peatland resource in the context of land use competition and environmental considerations
- produce a national peatland map and derived maps of the fuel peat reserves
- develop and apply the National Wetland Registry, producing a wetland data bank

The Program began in 1982 with a National Peatland Inventory Workshop and will continue until 1987/88 ending at the same termination date as the NEP-Peat Program.

Although a number of peat inventories, surveys and classification projects have been completed, are currently under way, or are being considered by the provinces, a standard methodology has not yet been accepted for use across the country.

Under the Program, areal extent of peatlands will be determined from remote sensing. Volume and quality of peat resources will be measured for selected peatlands in a given region, and then extrapolated to other peatlands in that region.

The Peatland Inventory Methodology Program is coordinated by the Ottawa Soil Survey Group and is being carried out in cooperation with Soil Survey Group regional offices and provincial soil survey units. The work is carried out both in-house and via contract. In-house field programs have been established in three regions:

- Pacific Coast - northwestern British Columbia and the Queen Charlotte Islands
- St. Lawrence Lowlands
- Southern Ontario

The collected data will be used to establish and test the methodology which will subsequently be applied to other peatland areas. In addition, the results collected from the St. Lawrence Lowlands will be used to evaluate the potential land-use conflicts which may arise in the event of peatland development.

An additional component of the Peatland Inventory Program is the National Wetland Registry. The intent of this initiative is to develop a standardized registry leading to a computer data-base of wetlands in Canada. The registry format now available allows classification of wetlands according to a range of variables, based on detailed field observations. The format is organized so that all information may be directly transferred to a computer data-base.

iv) Department of National Defence

The Defence Research Establishment of the Department of National Defence has been conducting on-going investigations to solve the problems associated with off-road terrain mobility. The types of terrain investigated are described as "marginal" terrain in terms of their trafficability. This includes vegetated surfaces as well as sand, snow, and peatlands or muskeg. In northern regions, the studies are directed toward snow-covered terrain and muskeg. The entire program involved with terrain mobility is coordinated through the Vehicle Mobility Section in Alberta. The investigations comprising the projects have been carried out on contract by university researchers, and have concentrated on two main areas of interest. The first has been to develop suitable methods of terrain analysis and the second to improve the performance of vehicles on difficult terrain.

Terrain analysis has been approached using remote-sensing techniques. A muskeg classification and mapping system has been developed, and information derived from this system has been used to design digital terrain models which will aid in predicting mobility in northeastern environments.

The actual problem of mobility has been addressed through investigations of the mechanical properties of muskeg, performance testing of tracked-vehicles and the development of a model to evaluate and predict the performance of tracked vehicles on "marginal" terrain such as peatlands.

v) Energy, Mines and Resources (EMR)

The Department of Energy, Mines and Resources (EMR) does not have a clearly defined position on peat from either the energy aspect or from the mineral and mining side of the resource. Part of the problem has been defining who should be responsible for peat at EMR. The Coal and Alternative Energy Branch is, in theory, responsible for peat. Both the Coal Division and the Renewable Energy Division have had some involvement in peat. The Coal Division is currently preparing a position paper with the intent to clarify the position which this Department will take. The Demonstration Section of the Renewable Energy Division was responsible for managing the Conservation and Renewable Energy Demonstration Program. This program included several fuel peat demonstration projects. It is now managing the new ENERDEMO program, although there are currently no peat projects included. The Renewable Energy Policy Section has also had involvement in peat through its representation on Peat Forum.

Much of the ambiguity concerning peat stems from problems regarding the current level of technology available in Canada and the perceived lack of potential for developing the resource. Peat technology is still considered to be in the R&D phase, and the Coal and Alternative Energy Branch does not have a mandate for Research and Development. Research and Development is the responsibility of Canada Centre for Mineral and Energy Technology (CANMET). The Combustion and Carbonization Research Laboratory of CANMET has had previous involvement with peat, including a series of peat resource evaluation studies and assessments of the technological feasibility of fuel peat development.

With the development of the National Energy Program Peat Program, R&D responsibilities for peat previously being carried out within CANMET were transferred to NRC, thus removing any direct R&D involvement with peat on the part of EMR. However, the likelihood still remained (as is evidenced by the recent peat demonstration projects) that peat would and could be used as a fuel source. Having taken a stance on promoting or advocating the use of other alternative energy sources (such as solar, wind, biomass, etc.), it seemed incongruous not to have a departmental position on the use of peat.

This became more obvious when peat was included as a separate program under the Renewables Task of the National Energy Program - the funding for which was being allocated through the Program for Energy Research and Development, chaired by EMR. Thus, for the moment at least, responsibility for peat has been replaced with the Coal and Alternative Energy Branch, although the Branch does not yet have plans to study or promote the use of the resource.

D. Federal/Provincial Initiatives

i) The Federal-Provincial Program for the Demonstration of Conservation and Renewable Energy

The Demonstration Section of the Renewable Energy Division of the Department of Energy, Mines and Resources manages a series of federal-provincial jointly-funded, jointly-operated demonstration programs which are designed to demonstrate conservation and renewable energy technologies that have evolved from the R&D phase and are ready for commercialization.

The first of these programs began in April 1979 and ran until March 1984. It included the Conservation and Renewable Energy Demonstration Agreements (CREDA), the Remote Communities Demonstration Program and the Québec Enerdemo Agreement.

As of April 1984, a new program came into effect. ENERDEMO Canada is the new national program, replacing all previous agreements, with similar aims to its predecessors. Interested provinces and the federal government are currently negotiating the terms of the new agreements. It does not appear that peat projects will be part of the new ENERDEMO program. Peat is considered to be a non-renewable energy source and although it is an alternative energy option ENERDEMO places greater emphasis on renewable energy demonstration opportunities.

Funding for the Demonstration Program comes from both federal and provincial sources. Separate agreements are established with each province, with the proportion of funding from each level of government varying from agreement to agreement:

Province	Federal	Provincial
	percent funding (%)	
Newfoundland	80	20
New Brunswick	80	20
Ontario	50	50
Manitoba	50	50
Saskatchewan	50	50
British Columbia	50	50
Northwest Territories	75	25 (Regional)
Yukon	75	25 (Regional)

For those provinces not listed, several had agreements under other programs. Nova Scotia had, at that time, an agreement under DREE (Department of Regional and Economic Expansion), now DRIE (Department of Regional Industrial Expansion). Prince Edward Island was covered by a related Conservation and Renewable Energy program which received 100 percent federal government support. Québec was also covered by a 100 percent federally-funded program called ENERDEMO, which was to run until 1988. This has now been absorbed into the new ENERDEMO Canada program. Alberta was also covered under a separate federal-provincial arrangement.

Although the CREDA program formally came to an end in March, 1984 there has been a wrap-up period of six months to one year for projects requiring it.

The Demonstration Program has three main objectives:

- develop and demonstrate promising technologies, techniques and systems which use renewable energy, conserve energy or make its use more efficient
- develop broad public awareness and acceptance of conservation and renewable energy technologies
- create employment in new or existing technologies

Funding for previous demonstration projects has been awarded to a variety of applicants, including:

- government departments and agencies
- municipalities
- associations
- colleges and universities
- industry
- voluntary and non-profit organizations
- consultants and other individuals

Projects applicable to energy use in all economic sectors have been eligible under the programs, including residential, industrial, agricultural, commercial, transportation and governmental sectors.

Three fuel peat demonstration projects were established under the Demonstration Program - two in Newfoundland under CREDA and one in Saskatchewan under the Canada-Saskatchewan Renewable-Conservation Demonstration Program. These demonstration projects in fact pre-dated the NEP-Peat Program by three years and came to an end just as the Peat Program was completing its second year. The funding available through the demonstration agreements has been the first financial incentive available which could be used to help bring a number of new energy technologies, including fuel peat, closer to a commercial level of operation.

1. Bishop's Falls Fuel Peat Demonstration Project (Newfoundland)

The Bishop's Falls demonstration project was in operation from June 1979 to March 1983, with the following objectives:[6]

- demonstrate the feasibility of mining fuel peat using the Haku and vacuum harvesting methods (both of which are dry-harvesting (mining) methods)

- demonstrate the feasibility of burning fuel peat in an industrial setting

The contributors to the project were as follows:[7]

CANADA (CREDA)	$ 653,280
Newfoundland (CREDA)	163,320
Joint Venture Partners (Memorial University of Newfoundland, Lundrigans, Newfoundland Ltd. and Noval Technologies Ltd.)	552,000
TOTAL	$1,368,600

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[6] Energy, Mines and Resources Canada and Mines & Energy Newfoundland, Fuel Peat Harvesting CREDA Project (n.p.: n.p., n.d.)

[7] Ibid.

Considering that it was the first project of its kind in Canada, difficulties were to be expected. In retrospect, the project has been of considerable value in pointing out the deficiencies of current "off-the-shelf-technology" in a Canadian (or at least Newfoundland) situation, as well as indicating that, with some improvements in this area, success is possible.

Bog preparation began in summer 1979 on a 50 hectare section of the 267 hectare High Point Bog near Bishop's Falls. Two production seasons were scheduled: summer 1981 and 1982.

Summer 1982 was the most successful production year when approximately 1,300 tonnes of peat were produced. At a price of $25 per tonne delivered to the mill, the project made a profit during that season. It was also intended that production should continue during the 1983 field season, but very poor weather conditions led to a disastrous season, and no peat was produced. Peat was mined from 20 hectares of the prepared bog area using Finnish equipment and two milled peat mining methods. In the fall, following mining, the peat was transported to the nearby Abitibi-Price Pulp and Paper Mill where it was burned in the mill's hog fuel boiler. During the first year (1981) the peat had a moisture content of 65 percent and when burnt, was able to produce only 65 percent as much steam as conventional fuels. In the following year, the peat had a lower water content (near 50 percent) and burn tests were more encouraging.

CREDA funding ended for this project in 1983 and production has been turned over to private industry (not, however, to supply fuel peat to Abitibi-Price). A new company, High-Point Peat, has been formed (from Noval-Technologies and Terra Nova Power Corporation) with the intent of producing a product called Oclansorb - a shredded peat product intended for use as an absorbent for industrial spills of oil and oil-based products.

The problems encountered by the Bishop's Falls Fuel Peat Demonstration Project began with the initial assessment of fuel and horticultural grade peat reserves. What was originally assessed as 45 hectares of fuel grade peat was, in fact horiticultural peat. Only 15 hectares of suitable fuel grade peat were available for the project. Because of the small amount of fuel available, the bog could not be expected to continue producing to satisfy Abitibi-Price's operational requirements, should this have been the original intention. Since the intent was purely for demonstration purposes, this was not a limiting factor.

Lack of experience in bog preparation led to initial problems in the early stages of the operation, particularly with the drainage. This did not interfere with the 1982 production season, however. The mining methods used in the projects, are weather-dependent and the very wet weather in summer 1983 brought the project to a virtual standstill. Although the project does look as though it will develop into a commercial venture, it was not successful in continuing in its original purpose of producing fuel peat. If production does continue, it will at least have led to the development of a peat-producing area where the same mining technology used in a fuel peat operation is being applied.

2. St. Shott's Peat Harvesting Project

The St. Shott's Peat Harvesting Project was initiated in 1980 by the Southern Avalon Development Association in an attempt to create a new industry and new employment in the region. Funding for the project was made available through CREDA and involved four sources:

- Energy, Mines and Resources
- Newfoundland Department of Mines and Energy
- Employment and Immigration Canada
- Department of Rural Agricultural and Northern Development (Nfld.)

The Southern Avalon Development Association managed the project through its newly-formed company Avalon Peat Harvesting. A consulting firm was hired on contract to prepare the bog for development and to help in equipment selection. Actual site work began in August 1982 and, during the fall of 1982, ditching was completed on the first 6 hectares. A further four hectares were ditched in January and February of 1983. Profiling and grading of the bog surface were carried out during July and August.

Two mining methods were used - mechanized sod-peat production using a Finnish-manufactured sod-peat extruder, and a hand-cutting and piling operation. The project was to have ended in March 1984, but because of the very poor weather in the production season of 1983, money was still available in the project budget and an additional season was approved for the summer of 1984.

When using dry-mining technology, a bog must normally be allowed to drain for a minimum of two years (but preferrably longer) before production can begin. There are two reasons for this. The first is to remove sufficient water from the peat so that the bog surface will support the mining equipment. The second is to lower the water content of the peat which is being extracted so that the extracted peat will require less air drying time on the field surface.

The use of dry-mining techniques resulted in serious problems for the St. Shott's project. The greatest problem was the time constraint placed on this project. The project had an official duration of 20 months (from August 1982 to March 1984) during which time the bog had to be prepared - ditched, drained, profiled and graded - and fuel peat had to be extracted, and ready for burning. As stated above, a bog must normally drain for a minimum of 2 years if dry-mining is to be used. One additional season prior to drainage for bog preparation is also required. Most peat-producing areas, do not produce a first production yield before a full three years. At St. Shott's, production began in July 1983 ony eight months following ditching on the first six hectares and before the final stages of bog preparation were complete on the rest of the bog.

Proper production cannot be expected with the kind of time constraints which were placed on the St. Shott's Project. Had the project started in 1979 or 1980, the results may have been very different. Since the site has had an additional year to drain, better results may be obtained from the 1984 season. However, the opportunity to mine the peat in 1984 was not anticipated in July 1983.

Regardless of the problems encountered as a result of the short time-span, considerable experience was gained from the project, particularly in realizing the limitations of using unmodified "off-the-shelf-machinery". The poor results to date may, however, have left a bad impression of the viability of such initiatives. New technologies are particularly vulnerable to negative impressions and should normally only be demonstrated when projects are properly set-up and the limitations fully understood and appreciated in advance. In the case of St. Shott's, an extension into the summer of 1984 might have been negotiated in advance in realization of its late start.

The poor weather during the summer of 1983 has frequently been blamed for the project's difficulties with production. Unfortunately, this region at the southern tip of the Avalon peninsula is one of the wettest and foggiest in Newfoundland. Climatalogical data are available, but studies were not carried out prior to site selection to determine whether or not the area is in fact suitable for the dry-mining technique used here. The site was chosen for socio-economic reasons and not for its particular suitability for sod-peat production.

If mining in the summer 1984 is successful, production will continue as a local, self-supporting industry. Earlier plans had been to use the fuel for domestic heating purpose. It was then suggested that the Fishery Products fish plant in nearby Trepassy could use the fuel to heat the plant. Burn tests carried out on the peat indicate that it would be suitable fuel for the purpose. During 1983-84, funds were awarded directly to Fishery Products to assess the size of bog needed to fuel the plant and the type of burning systems required, as well as the feasibility of producing electricity for the plant using a peat-fired generator. The basic problem with choosing Fishery Products as a potential user is that the plant has not been a reliable market. The plant was out of operation during the fisheries restructuring process. It did reopen but due to labour disputes in the fisheries it has been forced to close once again. Such disruptions are however, usually only short-term delays and the plant may prove to be a suitable market for the peat produced at St. Shotts.

3. Buffalo Narrows Fuel Peat Demonstration Project

The Fuel Peat Demonstration Project at Buffalo Narrows in northwestern Saskatchewan was financed under the Canada-Saskatchewan Renewables-Conservation Demonstration Program. One half of the financial support came from Energy, Mines and Resources Canada and the other half from Saskatchewan Energy and Mines. The purpose of the project was to demonstrate the feasibility of producing and utilizing sod peat for domestic heating purposes in this remote, northern community. It was originally predicted that the fuel peat extracted at Buffalo Narrows could replace 80 percent of the fuel oil used in the community and at the same time provide local employment from community-based resource development.

The project originally received $500,000 in funding and was to have been in operation from 1981 to the end of the agreement program in 1984. The project in fact ran from spring 1981 to late summer 1983 and received a total of $397,000.[8] The reason for this was a change in the provincial government in Saskatchewan and the premature withdrawal of the province's commitment from the demonstration agreement.

During the first phase of the project (spring 1981 to spring 1982) 5 hectares of a 60 hectare bog near the town site were prepared and ditched for drainage. Ditching did not begin until December, 1981. During that winter, fuel peat imported from Finland was tested in three imported furnaces (two of Finnish design and one of German design). During the second phase (spring 1982 to summer 1982), brush and a layer of poorly-decomposed peat was removed from the bog surface, and the surface was levelled and profiled. Production was to begin in the summer but cool, wet weather in the spring and summer hampered drainage and delayed production until September, 1982. Because of this late start, only 8 tonnes of fuel grade sod-peat were produced from half of one production field, using a Finnish-built Meri extruder. The bog had been allowed to drain for less than 10 months. It was intended that the peat should air-dry on the bog surface, which would normally require six to eight weeks of reasonably dry weather. Rainy, fall weather required that the peat be moved indoors to a warehouse where it was allowed to dry to a water content of approximately 40 percent.

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[8] Energy, Mines and Resources Canada and Saskatchewan Energy and Mines, Fuel Peat Demonstration Project Summary (n.p.: n.p., 1983), n. pag.

During the winter of 1982-83, the extracted peat was burned in two of the imported peat furnaces and two oil/wood furnaces (with modified grates) in private homes in the community and in one imported peat furnace in the Buffalo Narrows Municipal garage.

The Saskatchewan Research Council had set up a program to monitor the efficiency of heating with peat. However, the monitoring program ran into difficulties with basic energy "bookkeeping", which was largely dependent on the participation of the residents who were testing the fuel. Had the project been able to continue through its second production season during the summer of 1983 and test burns during the winter 1983/84 as originally scheduled, much of the valuable experience gained from the first production and burning phases could have been applied to achieve better results. The Department of Northern Saskatchewan was heavily involved in managing the project. Following the provincial elections in 1983, this department was disbanded (before the project was complete) and provincial funding for the project was withdrawn.

As was the case with the two Newfoundland projects, wet weather is cited as the dominant factor leading to problems encountered during the production season. Probably, the more serious problem was the time element - initially a three-year project which was cut back to two years. The bog did not have time to drain properly prior to the first production season (it was intended that production should begin after only 6 months of drainage - during most of which time the ground was frozen and proper drainage was unlikely). A second production season would have meant that the bog would have been draining for at least 18 months, and the chances of a successful production season would have greatly increased. The most serious problem however, was the lack of government commitment to the project, as evidenced by the provincial withdrawal of funds. The reasons for this are not clear, but it may be assumed that the new government did not consider this type of development to be of great significance in the current provincial energy program.

ii) Federal-Provincial Agricultural Agreements

Two federal-provincial agricultural agreements have been used to undertake peat research and development activities. From 1978-1983, several peat agricultural projects were approved under the Canada-Newfoundland Agricultural Development Subsidiary Agreement (A.D.S.A.). (A new agreement is currently being negotiated). Under the A.D.S.A. program, machinery development and land development techniques were researched to enable vegetable, specialty crop and sod production on peatlands.

A Canada-British Columbia Agriculture and Rural Development Agreement from 1977-1982 was used to fund the Wetland Meadows Development Program. This program was used to encourage the improvement of peatlands for forage crop production in the Interior.

III THE PROVINCIAL GOVERNMENTS

A. Introduction

The level of peat-related activities and their focus varies widely among the provinces. This chapter describes:

- peat-related programs of key departments or ministries in each province
- provincial legislation pertaining to peat development
- peat-related policies or guidelines which several provinces have formulated to direct various aspects of peat development.

B. Agency Activities

i) Newfoundland-Labrador

a. Overview

The Island of Newfoundland is frequently subdivided into three general land types: one-third forest, one-third barrens and one-third bogs (or peatlands) and water. Peatlands are found in all parts of the island and vary in size from less than one hectare to several hundred hectares. Newfoundland peatlands are not treed, but are generally covered with low-lying brush. They are therefore of no significant value to the province's forest industry. The peatlands have also had little agricultural or other commercial importance in most parts of the province. Newfoundland peatlands, however, have always held an attraction for a small number of interested groups and individuals, including researchers, agriculturalists, foresters, engineers, land developers, and most recently - entrepeneurs. Much of this interest has intensified during the past five years when two Conservation and Renewable Energy Demonstration Agreements (CREDA)-sponsored peat-mining demonstation projects were initiated in the province.

Interest in peatland utilization has a relatively long history in Newfoundland. Peatlands have always been used to a limited and very local extent (particularly prior to confederation), on the southern portion of the Avalon peninsula. Peat was dug out of the bogs with shovels (or axes in the winter) and used as a heating fuel. This practice, made necessary by the lack of wood in the region, virtually disappeared once oil became available. Peat moss is still removed in very small quantities for use as a soil ameliorater.

Newfoundland has very scarce mineral soil resources, and thus a very small agricultural land base. Following Confederation, the population increased dramatically and the island became dependent on all forms of imported food products. One of the most significant changes at that time was the very large decline in the livestock population of the island. This was largely in response to the change in land use practices on Newfoundland. A Royal Commission on Agriculture in Newfoundland was set up to study the province's agricultural situation and, in 1955, published its report. The report suggested that the province's agricultural land base could be expanded by making greater use of the peatlands which cover 20 percent of the Island. The study led to recommendations advocating:

- A comprehensive inventory of the bogs in Newfoundland
- Experiments concerning the cultivation of bogs in connection with the building of a Research Station for Bog Cultivation
- Establishment of a demonstration factory for the production of moss litter
- Training of specialists to lead the proposed project.

Following these recommendations, the province hired an Irish "boglands engineer" to study the possibilities of reclaiming peatlands for agricultural purposes and to initiate experiments in this area. Experiments were started in 1956 with the following objectives:

- determine the suitability of Newfoundland organic deposits for grass and hay crops
- determine the average unit cost of reclamation.

Since that time, much of the effort in peatland development has been concentrated on agriculture - particularly on improvement of lands for grazing and forage production. Peatlands have been drained and set aside for community pasture, and the Agriculture Canada Research Station at St. John's operates the Colinet Peat Sub-Station where numerous studies have been carried out over the past 20 years on peatland drainage, crop selection and fertilization and mechanized cultivation.

In recent years, attention has been diverted somewhat from the agricultural use of peatlands toward peat extraction for fuel purposes. The two CREDA demonstration projects at Bishop's Falls and at St. Shott's have done much to revive this interest.

b. Major Actors and Initiatives

1. Department of Rural Agriculture and Northern Development

This department is organized into three branches: Rural Development, Northern Development and Agricultural Development. Activities involving peatlands are the reponsibility of the Agricultural Development Branch and are handled through the office of the Peatland Coordinator.

The objective of the Department and the Branch is to achieve self-sufficiency in agricultural products and to provide a bridge between agricultural research and commercial development. Over the past 25 years, the emphasis on peatland agriculture has been to improve peatlands for grazing and forage crop production. The provincial Agricultural Branch and the Peatland Coordinator have worked in close association with the Agriculture Canada Research Station in the areas of peatland development. However, the role of the Department of Rural Agriculture and Northern Development is development, not research, and its concern has been to encourage the development of peatlands, thereby increasing the province's agricultural base.

The use of peatlands for agriculture has increased somewhat in Newfoundland since interest was first expressed following the Royal Commission on Agriculture in Newfoundland in 1955. Many peatland areas are now being used as community pastures. Yet, although considerable experience has been developed in various preparation and cultivation techniques (including drainage, seed-bed preparation, fertilization and, to some extent, mechanization), Newfoundland farmers have been hesitant to adopt these practices and apply them to large-scale farming.

In 1976, the (then) Department of Agriculture commissioned a study[9] to assess policies regarding peatland development in the province. The study concluded that the "Bogland Development Program for the Reclamation of Bogland for Commercial Agriculture" was not meeting its objective of bringing peatlands in the province into agricultural utilization. The intent was to provide recommendations on the implementation of the existing bogland policy, or to develop new policies and guidelines which would encourage agricultural development. The report presented an assessment of the problems associated with the existing policy, and peatland production in general, and offered recommendations for future development.

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[9] Nordco Limited and Newfoundland Department of Agriculture, Report on the Peat Bog Policy in Newfoundland (n.p.: n.p., 1976), pp. 26-28.

The problems which were identified in the report are summarized as follows:

1. Newfoundland farmers are not stockmen by tradition and therefore are not likely to adapt readily to the industry; this was cited as being due to a general lack of understanding of the livestock industry and the costs involved in livestock production.

2. The relatively harsh climate, and thus relatively short growing season, restrict agricultural production in Newfoundland.

3. The equipment necessary for production on peatlands was not available, or existing equipment had not been developed to suit Newfoundland's needs.

4. Agricultural education was lacking in Newfoundland; as a result, few young Newfoundlanders were encouraged to enter the profession.

5. The government policy: "Bogland Development Program for the Reclamation of Bogland for Commercial Agriculture" was criticized as being too structured and costly for farmers to become involved with it.

6. The economic viability of bringing peatlands into production was questionable.

7. Weed infestation on cultivated peat soil is very difficult and costly to control.

Recommendations for future development were made. Summarized below, they include:

1. Improve the educational programs available to farmers on the topics of general livestock management, farm management, cropping practices, machinery, etc.

2. Improve the communication between the farmers and the Department of Agriculture.

3. Assess peatland development methods used elsewhere in Canada or overseas.

4. Improve the equipment available for peatland agriculture and assess the use of European equipment in a Newfoundland situation.

5. Set up a pilot project to study the problems of peatland development (preferrably on the west coast where the climate is more moderate and limestone is available to reduce soil acidity).

6. Reappraise the incentives offered to farmers wishing to develop bogland (at the time, the maximum incentive was $2,000, which was deemed insufficient to meet the costs of development).

7. Reassess or introduce new development policy more favourable to small-scale farmers who do not have the capital or equipment to properly develop boglands.

The original bogland reclamation policy was abandoned and has not been replaced since. However, several of the recommendations were implemented through other programs. The office of the Peatland Coordinator appears to have improved communication with respect to peat-related problems. The Agriculture Canada Research Station had already been established long before these recommendations were introduced so that agricultural test areas were already in operation. The pilot study to investigate problems of peatland development was not established, but considering that the west coast of the island has a mineral soil resource and is agriculturally productive, it made little sense to carry out peatland agriculture in this region. Several peat agricultural projects were approved under the Agricultural Development Subsidiary Agreement 1978-1984. These have addressed problems of inadequate machinery, crop selection and cropping techniques as well as soil fertility. Financial incentives for peatland development have not been improved.

2. Development Opportunity Program - Canada/Newfoundland Agricultural Development Subsidiary Agreement (ADSA) - 1978-1984

The Development Opportunity Program was one of eight programs of the Canada-Newfoundland Agricultural Development Subsidiary Agreement (ADSA). The original agreement was between the (then) federal Department of Regional Economic Expansion (DREE) and the province covering the period July 1978 to September 1982. In 1982 federal responsibility was assumed by Agriculture Canada. The agreement formally concluded on March 31, 1983. A new agreement is currently being negotiated with the province, and negotiations are expected to be finalized by March 1985. Applications for new projects will not be accepted until the agreement is negotiated.

The purpose of the original program was twofold:

- provide technical and financial assistance to farmers wishing to try new technologies
- communicate the results to the agricultural community and the general public.

These objectives essentially reflect technology transfer, information exchange and education. The total funding approved for the program was $2,027,600. Between July 1978 and March 1983, 45 projects were approved, but the program started slowly. In 1978/79 only three projects were approved for funding. In 1979/80, four projects received approval. It wasn't until the third year of the Program 80/81, that potential applicants, i.e. farmers, became well aware of the program and of the opportunities for financial assistance. In 1980/81, 19 projects were approved and in 81/82, 15 received approval. In the final year, 1982/83, only 4 projects were funded.

The Interim Report (July 14, 1978 to December 31, 1982)[10] acknowledges this slow start and indicates that many projects would complete only the initial stages of development before the March 31, 1983 deadline. However, any projects which had not used their funding by the end of the Program have been allowed to continue during the interim period 1983 to 1985 until a new agreement is reached.

The Program was divided into four categories: Horticultural Activities; Livestock Activities; Livestock Feed Activities; and General. Three peatland projects were funded under this program; two under horticultural activities (a. Vegetable Production on Peatland, and b. Speciality Crop Production on Peatland) and one under general (c. Sod Production on Peatland). Peatland projects were not attempted under Livestock Activities or Livestock Feed Activities despite the fact that much emphasis in the past had been placed on improving peatlands for use in pasture and forage crop production.

- Vegetable Production on Peatland

  This project was approved in 1978/79; therefore having full benefit of the 5 1/2 year period. The project received considerable funding - $182,651 - considering that the majority of grants awarded were between $10,000 - $50,000.

  The objective of the project was to determine crop suitability, machinery and drainage requirements for the viability of commercial vegetable production on peatlands. The project was a joint effort between the farmer-landowner, Agriculture Canada researchers and the Agricultural Branch of the Department of Rural, Agriculture and Northern Development. The project consisted of two main aspects: Land Development and Machinery Development.

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[10] Bartlett, L., Development Opportunities Program Interim Report (St. John's: Department of Rural Agricultural and Northern Development, 1982)

The Land Development work was organized by Agriculture Canada to test ditching techniques, monitor changes in the hydraulic regime, select crop types and conduct growth trials. Forty hectares were ditched and drained and 30 hectares were limed and rotovated. The landowners (along with Agriculture Canada) planted a number of crops in order to select the most suitable variety. Although good results were obtained with cabbage, celery, turnip, broccoli, beet and rapeseed, cabbage showed the best overall results and proved the easiest to manage.

The Machinery Development work tended more toward machinery selection, purchase, and testing rather than actual development of new or improved machinery. Some of the purchased machinery was modified, as particular deficiencies in the acquired machinery were quickly noticed. The purchased machinery remains with the farmer and it is hoped will be used for further production on this land. However, as of summer, 1984, the land had not entered commercial production.

The project has been heavily research-oriented, both in the general project objectives (to determine or demonstrate the feasibility of vegetable production on peatlands) and in the nature of the work carried out. There has been little opportunity to bring the project into full-scale development following the end of the program, and the vegetable farm has not yet become a commercial venture. The involvement of the government agencies in research - particularly in drainage techniques and crop selection - did satisfy the technical assistance/technology transfer aspect of the project. However, the aim to bring the land area into commercial production was not reached. This is in large part due to the length of time necessary to prepare peatland for vegetable production, on average 5-7 years. It is possible that, with the preparatory work now finished, this project would be ready to attempt commercial production under a new program which might be available through the new agreement.

- Specialty Crop Production on Peatland

The project was approved in 1981/82 and received $8,000. It was to involve the two government agriculture departments (federal and provincial) and a private farmer/landowner. The objectives of the project were to use 50 acres (20 hectares) of previously drained peatland for specialty crop production, and to obtain suitable machinery for production. By March 1983, only 3 acres (1.2 hectares) had been limed, fertilized, rotovated and planted with a variety of vegetable crops. However, in order to expand production, the peatland would have to be adequately drained and proper machinery acquired. The land has since been drained, but suitable machinery has not yet been acquired, and by summer 1984, the funding still had not been used in this development scheme.

- Sod Production on Peatland

This project, which was awarded $25,250.00 in 1981/82, was to be a joint project with considerable involvement from the Newfoundland Agriculture Branch and Agriculture Canada. The project was intended to demonstrate the capacity of producing landscape sod on peat and to establish a machinery base for sod production. However, due to problems with site selection this project never did develop and the allocated funding has not been used.

3. Department of Mines and Energy

Both the Mines Branch and the Energy Branch of this Department are involved in Peatland Development. The Mines Branch is responsible for managing leases under the Quarry Materials Act, 1976 and was recently given responsibility to complete the provincial peat inventory. The Energy Branch has had the responsibility of managing the Conservation and Renewable Energy Demonstration Agreements (CREDA) projects.

Peat activities in the Department of Mines and Energy have been largely dependent on external funding and once this funding for special projects such as CREDA ends, the Departmental role in managing or developing peatlands is reduced to that of administering quarry permits and leases. It does not appear that provisions for peat activities will be made in the internal programs of this Department.

- Mines Branch

The Mineral Division of the Mines Branch has responsibilities to map, evaluate, develop and manage mineral resources. Although peat is not defined as a mineral resource, the Division views it as being a pleistocene commodity and as such it has been classified as a quaternary resource, thus falling within the responsibilties of the Division. One of the responsibilities of this Division to manage any leases which may be granted for peat mining (along with all other mining operations). However, the only licenced peat operaton to date has been the High Point Bog operation near Bishop's Falls.

The Division has also had the responsibility of completing the provincial peatland inventory. This inventory was originally conducted by the Department of Forests and Lands beginning in 1977/78. The original funding agreement was between the federal Department of Regional Economic Expansion (DREE) and the provincial Department of Lands and Forests. The inventory is based on the Wetland Classification System developed by the National Wetland Working Group. All peatlands in designated regions were mapped, providing a first level inventory based on morphological interpretation fom air photos. Approximately 700 bogs have been sampled in detail, recording area, vegetation structure, depth and peat type and 300 bogs were tested for degree of humification (half way through the sampling program, humification rating was changed from the botanical classification to the von Post scale, and this has caused some confusion in comparing the data from different sites). The information has been used to obtain a volume estimate for the horticultural and fuel reserves in the province.

When the DREE agreement came to an end, the inventory program was transferred to Department of Mines and Energy. Only one section of the province (the southwest quadrant) remained to be mapped; this work is being completed in 1984/85. However, because of budgetary constraints, the mapping will be less detailed than in previous years. Some funds have been allocated from the CREDA program to carry out the final year of the inventory. CREDA is providing $20,000 and an additional $20,000 is coming from internal Mines and Energy funding.

- Energy Branch

The Energy Branch has been involved in peat development through the CREDA program and has been responsible for administering the provincial elements of the agreement. In Newfoundland, emphasis on alternative energy development was placed on wood and peat energy. (The fuel peat demonstration projects are described in detail in the chapter on federal programs and activities, which also discusses federal-provincial agreements and cost-sharing programs). With the exception of the CREDA projects, this department has had no other programs involving fuel peat. A new demonstration agreement under the ENERDEMO program is not being negotiated and although some internal programs for wood energy are being investigated, the Branch currently has no plans for involving peat energy. The Branch will be responsible for the St. Shott's project until March 1985, after which time it is intended that the project will become an independent commercial venture.

4. Department of Development

This Department has a general mandate to assist with the development aspects of the resource industry. Peat has received some attention in this regard, mainly in determining which markets are available for peat products and which peat products Newfoundland could competitively develop.

The Department has sponsored several market studies for peat moss, but a significant peat moss industry has not yet developed in the Province. Newfoundland imports horticultural peat from the maritime provinces and Quebec. The various market studies have suggested that the capital investment is too high and the local market too small to support establishment of a peat industry in Newfoundland. It is also unlikely that Newfoundland would be able to compete in the export market, paricularly in the eastern United States where the market is already well penetrated by peatmoss suppliers from the maritimes and Quebec.

Other possibilities which are cited as areas of potential growth have been in sod grass production and horticultural products. However, the recent experiences of projects under the ADSA program question the extent to which these alternatives show any real potential in the near future. Their successful development requires a much more committed effort on the part of entrepreneurs, and developers, and also requires Government incentives which are sensitive to the relatively long time it requires to bring a peatland into production.

c. Legislation Pertaining to Peatland Development

While there has been a long history of peat use on Newfoundland, particularly on the Avalon Peninsula, peat extraction has always been on a small scale for domestic purposes or for horticultural use. Certain areas have in fact been designated for domestic use and small amounts of peat may be removed from these areas. To date, the only commercial-scale activities have been the fuel-peat demonstration projects at Bishop's Falls and at St. Shotts.

Peat extraction is subject to the conditions of the Quarry Materials Act, 1976. The act states that:

> "quarry material" means any substance which is used or capable of being used in its natural form for construction or agricultural purposes, and includes
>
> (i) sand, gravel, stone, soil, peat and peat moss...
>
> (Section 2(c) of the Quarry Materials Act, 1976)

In the case of commercial development, the developer must first apply for a one-year, non-renewable Quarry Permit. The application must be accompanied by a plan showing the area to be developed, and a rental fee of $15.00 per hectare. A royalty of 15¢ per cubic meter of material removed must be payed within 60 days of expiry of the Permit.

Extraction of peat for domestic use also requires a permit, but rental fees and royalty payments are waived. The permit may then be followed by a Quarry Lease which may be renewed for two terms (of up to 20 years duration each). A rental fee of $15 per hectare must be paid and a royalty of 15¢ per cubic meter of removed material.

The commercial permit for peat extraction is a Peat Quarry Permit, although it is in no way different from a regular quarry permit. The name merely refers to the material being removed. The conditions of the Quarry Permit are clearly designed for quarry operations and have little relevance to peat mining operations. The first real test of the applicability of this Act with regards to Peat came when the Bishop's Falls project became a private operation. The one-year permit was accompanied by an addendum which addressed several aspects of the peat mining process, including ditching, roads, removal techniques and rehabilitation. However, there was no requirement that a rehabilitation development plan be included with the site plan and application.

If peat development continues in the province, regulations which have greater relevance to peat operations will most probably have to be developed. Such obvious sections of the Permit and Lease such as 3b of the Permit and 4 of the Lease (referring to pollution or interference of ponds, brooks or rivers), 4c of the Permit and 2c of the Lease (referring to conservation of topsoil), and 4h of the Permit and 2f of the Lease (referring to reclamation and replanting) will have to be assessed in view of the nature of peat mining.

Peatland development is also subject to the conditions of the Environmental Assessment Act, administered by the Department of Environment, and must be registered with the Department if the development can be described by the following criteria:

- a land area greater than 50 hectares to be drained
- an excavation involving removal of more than 1,000 cubic metres of material

The Registration Process involves a screening by all government departments. If any environmental concerns are identified, the Minister of the Environment may request that an Environmental Impact Statement (EIS) be prepared and that an assessment committee be established to oversee the project. Following the completion of the EIS, the Minister recommends to the Lieutenant-Governor in Council that either: 1) the proposed undertaking be permitted to proceed; subject to any conditions that the Lieutenant-Governor in Council might order or: 2) it not be permitted to proceed.

The Environmental Assessment Division is currently moving toward developing a single set of guidelines for preparing an EIS for resource development, but does not have any specific guidelines which address the issues of rehabilitation and monitoring with respect to peatlands. In the absence of a completed assessment of a peat development, the recommendation of the Minister must refer to any guidelines available from the Department of Mines and Energy concerning peat mining and abandonement. As noted above, such guidelines are not of particular significance to peatland development, and they themselves require modification.

Both the Department of Environment and the Department of Mines and Energy have acknowledged the need for a set of peat development guidelines. The Bishop's Falls development illustrated the inadequacies of the current regulations. However, in the absence of growth in the industry, development of these guidelines has been receiving low priority.

Currently, only High Point Peat is considered to be a commercial peat operation and as such the company has had to register the plant which it will use to produce its product. However, an EIS was not required since operation was not considered to be large enough to warrant an impact assessment. Had an EIS been requested, it would have been the responsibility of the proponent - in this case High Point Peat - to prepare it.

ii) Prince Edward Island

a. Overview and b. Major Actors and Initiatives

If peat were to be developed in the province of Prince Edward Island, two government agencies would have the main responsibility for this task. Energy aspects would be addressed through the PEI Energy Corporation. All other development aspects would be channelled through the Mineral Development Coordinator of the Energy and Minerals Branch, Department of Energy and Forestry. Given the limited extent of the resource and the limited access to it, it does not appear likely that peat will be developed on PEI, nor will projects be introduced to encourage this development.

The Province has, however, given some consideration in the past to the potential for developing the peat resource. In 1972, a consultant was commissioned by the Department of Industry and Commerce to study the peatmoss resource on the Island. Of the approximately 80 known deposits on the Island, 21 were identified as warranting further investigation. These deposits were categorized into three groups, according to their "workability" (e.g. size, brush cover, drainage characteristics) with regard to horticultural peatmoss development. In a short internal summary "Peat Moss Deposits on Prince Edward Island",[11] these deposits were identified according to their areal extent, location and ownership. Some information was also made available on the volume of peat in the various counties, and very limited data were presented on the production capacity of these areas.

In 1975, Maritime Electric commissioned a preliminary study of the fuel peat potential on the island. Based on very scant information, it was suggested that there was enough fuel peat on the island to sustain operation of a 50 MW power plant for 30 to 40 years. This opportunity was not pursued further. The only peat resource assessment available has concentrated on horticultural grade peat and little is known about the fuel-peat potential of the Island, although it is generally accepted that fuel-peat development offers little potential in PEI and the main deposits are of horticultural grade material.

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[11] Prince Edward Island Energy Corporation, Peat Moss Deposits on Prince Edward Island (Charlottetown: P.E.I. Energy Corporation, n.d.) n.pag.

There is a small horticultural peatmoss industry on the Island. The main producer is Gulf Island Peat Moss, which owns 3 bogs with a total area of 930 acres (423 hectares). Only a small portion of this area is in production, and the bulk of the annual production is exported. In addition, a small peat deposit (168 acres or 76 hectares) is owned and operated by the Lennox Island Band Council. Their production is sold to local nurseries.

There has been little incentive provided through the government to develop peat. There were no peat projects sponsored by the PEI/Canada Renewable Energy Demonstration Agreement which ran from 1978 to 1983. The alternative energy emphasis in PEI has focused primarily on wood and secondarily on solar and wind energy. A second joint program, the PEI Comprehensive Development Program, concluded in March 1984 after 15 years of operation. Peat development was not addressed by this project, although wood burning received attention from the energy component of the agreement.

The province has maintained a representative on the Inter Provincial Advisory Committee on Energy-Peat Technical Working Group (see Appendix 6), but the intent has been to keep informed of developments in other provinces. The general consensus at the moment is that the apparently limited fuel-peat potential on the Island does not warrant energy development and that if peat development is to be encouraged at all, it should be in the horticultural peat industry. To do this would require that a proper inventory be carried out. At the moment, however, development funds will most likely be allocated to other energy or agriculture-oriented projects.

c. Legislation Pertaining to Peatland Development

Less than 10% of the surface land on Prince Edward Island is owned by the Crown and, although the Province does have the rights to develop mineral resources on private lands, the Mineral Resources Act, 1978 - Section 1K, stipulates that peat, along with sand, gravel and soil is not considered to be a mineral. Therefore, the ownership of the peat resource remains largely with the landowner. Thus, in the majority of cases, the Crown does not have direct responsibility for the resource, except in those areas where the peat occurs on public lands.

Responsibility for the disposition of peat is ambiguous. Peat extraction is not referred to in either the Mining Act or the Excavation Pit Regulations of the Planning Act. Yet, given the nature of peat mining activity, it is generally acknowledged that peat activities would be subject to the Excavation Pit Regulations. This legislation is administered by the Environmental and Consumer Section of the Department of Community and Cultural Affairs which would, presumably, issue the licences for any excavation. Since this legislation pertains only to Crown lands, it is unlikely that it will be amended to suit a resource of which only 10% can be controlled by the Crown.

iii) Nova Scotia

a. Overview

Provincial activity in peat resource development is very new in Nova Scotia. In 1979, the Provincial Government declared that it would work toward reducing the dependency of the province on imported oil. This would require an active energy conservation program as well as increased efforts to develop indigenous energy sources. The main area of activity of the province has been renewed development of provincial coal reserves. Some interest has also been directed toward the province's peat resource as a possible resource for energy development.

b. Major Actors and Initiatives

1. Department of Lands and Forests

Resource development and management in most instances is the responsibility of the Nova Scotia Department of Lands and Forests. The involvement which this Department has had with peat or peatlands in the past has been limited. One major initiative has been a program operated by the Wildlife Division to classify and evaluate the province's wetlands for the purpose of wildlife management. Another is a program undertaken by the same division, in cooperation with the Canadian Wildlife Service and Ducks Unlimited, to manage approximately 1,500 hectares of peatland in the Chignecto Isthmus, an area which is being managed for water fowl production.

The Department has not had any previous interest in developing peat or peatlands as a resource, nor has it conducted any peat resource studies within the context of internal programs or projects.

2. Department of Mines and Energy

Since the most recent provincial interest in peat development has been in the energy sector, the task of assessing the extent of the resource - normally the responsibility of the Department of Lands and Forests - was given to the Resources Energy Division, Nova Scotia Department of Mines and Energy. The Peatland Inventory Program, was established in 1979 with the mandate to investigate the fuel peat resource in the province. The Program is beng funded through a Mineral Development Subsidiary Agreement with the federal Department of Regional Industrial Expansion (DRIE). Upon completion of the program in 1985, the inventory will have established the following:

- areal extent and volume of fuel-peat
- locations of the most viable fuel-peat reserves.

The first stage of the inventory was to determine, from existing Canada Soil Survey Maps (1:125,000), where the largest deposits of organic soils occurred. It was found that, although peatlands are found in almost every region of the province, they tend to be concentrated in six major regions. The most important regions are in the southeast in Yarmouth, Shelbourne and Queen's Counties; on the eastern shore in Guysborough County; and on the northeastern tip of Cape Breton Island. The peatlands in the six major regions are being investigated in greater detail. All deposits are being mapped using aerial photography, and detailed field information is being collected on those deposits larger than 50 hectares.

A second project of the Peatland Inventory Program is being carried out in cooperation with the Nova Scotia Land Survey Institute. The objective of the project is to develop a methodology using remote sensing techniques (basically Landsat digital data) which can be used to estimate the volume of peat deposits. The method uses an observed correlation between vegetation cover and mean depth of deposit, leading to a predictive model which will estimate mean depths based on the surface vegetation. It is not intended that this technique should be extrapolated to peatlands across the province, but rather to extrapolate depths (measured from several "representative sites" in a region) to peatlands within the same region.

A third project is to investigate the feasibility of developing a fuel-peat industry in southwestern Nova Scotia. A feasibility study has recently been carried out on contract and was completed during summer 1984. The province is now making its decision whether or not to proceed with the project, based on this study. The study addressed the following factors:

- selecting the most suitable bogs for development and proposing a development plan
- identifying potential commercial users
- developing a production system
- proposing an environmental monitoring program
- proposing a rehabilitation plan.

As yet, funding arrangements for such a project have not been developed. Since Nova Scotia does not currently have an agreement with the Federal-Provincial Energy Demonstration Program, it is unlikely that funding will come from this source. It is also not clear at the moment which departments would become involved in such a project. Logical possibilities might include the Department of Development and/or the Department of Lands and Forests.

The federal government has shown considerable interest in the project, but purely from an R&D perspective. The National Water Research Institute, Environment Canada, has set up monitoring stations in the Barrington Bog catchment in order to collect information on the pre-development water chemistry of the catchment streams. This will provide valuable baseline data for monitoring changes during development, should a project be approved.

The reason for selecting this part of the province has been as strongly related to socio-economic factors as it has been to the large concentration of exploitable peatlands in the area. The decision to promote peat development in this area was taken in order to make use of an indigenous resource which would supply local energy needs (heating only) and provide increased employment opportunities in the summer months.

The province has not indicated any interest in the other potential uses of peatlands. Agricultural potential has not been seriously addressed although some work had been conducted in this area (particularly with respect to the Annapolis Valley) during the 1970s.

The province does have a small horticultural peat moss industry consisting of one producer - Annapolis Valley Peat Moss - who produces an average of 150,000 bales of peat moss per year. Little has been done to encourage the development of this industry in Nova Scotia, despite the fact that Nova Scotia is comparable to New Brunswick in terms of climate production days and proximity to markets. (New Brunswick is considerably more active in the horticultural peat moss field.)

c. Legislation Pertaining to Peatland Development

Peat is considered a quarriable material and as such it is subject to the general regulations of the Mining Act. However, in anticipation of possible future dvelopment Lands and Forests is currently developing peat disposition guidelines which could be applied according to the requirements foreseen for individual development projects.[12]

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[12] Mr. McAuley, Nova Scotia Department of Lands and Forests personal communication, 16 July 1984.

General Wetlands Policy

Although peatlands themselves have not been a prominent issue in Nova Scotia, the province has previously shown some indication of developing a general wetlands policy. In 1978, the Environmental Control Council of Nova Scotia solicited comments and opinions from a number of agencies, including Environment Canada, regarding the possibility of developing a formal wetlands policy for the province. The Council was particularly interested in the importance of specific fresh and salt water wetlands with respect to environmental and long-term economic values (i.e. as opposed to short-term commercial opportunities).

The interest was prompted by recognition of the fact that, while current legislation contains some authority for regulations governing wetland use, there is (as in other provinces) neither specific legislation nor regulations addressing either coastal or upland wetlands (i.e. peatlands, swamps and fresh water marshes) or salt marshes. Nova Scotia has not yet adopted a formal wetland policy (which would encompass peatlands), and there appears to be little action in this direction at the moment.

iv) New Brunswick

a. Overview

Currently, the only development occurring on peatlands in New Brunswick is horticultural peat moss production. Over 2,500 hectares in the Northeast region of the province are being harvested. A very minor amount of fuel peat was produced for testing purposes at a small peat-fired boiler at Lamèque, New Brunswick but this project did not develop further. Only one peatland is used for agricultural purposes and there is little interest in the province to use peatlands for forestry.

Ducks Unlimited currently manages 34 sites as wildlife habitats - essentially for water fowl conservation. This group is the largest single user of wetlands (including peatlands) in the province and currently owns over 5,000 hectares. The group acquires the areas from farmers or other land owners who see little or no economic value in the land.

Twenty-two peatland areas, comprising 4,500 hectares, are within Kauchibouguac National Park and are thus protected from development. Parks Canada has a nature study area on one of these peatlands. Selection of representative peatlands in other portions of the province has been requested.

Although the Province now has a very detailed assessment of its peat resource (see below), it has not yet developed detailed management plans or strategies, in particular for those regions where extensive peatlands occur. The Crown Peat Resource Management Policy (discussed in the legislation section below) addresses only the utilization aspects of management. There is, however, an indication that a management strategy will be developed.[13] It is intended that the policy will address the development of economic resources and the conservation of both economic resources for future generations and uneconomic resources for wildlife habitats. The policy will also attempt to resolve reclamation or abandonment procedures.

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[13] Mr. Ron Shaw, Coal/Peat Geologist. New Brunswick Ministry of Natural Resources - letter 19 July, 1984.

b. Major Actors and Initiatives

1. Community Improvement Corporation

All peat and peat-related government activity in the province has been dependent on funding from the development and subsidiary agreements which have been in place over the past 10 years. From 1974 to 1984, the General Development Agreement (GDA) between the provincial premier and the Minister of Regional and Economic Expansion has been the umbrella agreement. This agreement has allowed DREE to transfer funds to the province for the purpose of economic development. FY 84/85 will be used to complete existing programs and projects under the current Agreement. The GDA will eventually be replaced by the Economic and Regional Development Agreements (ERDA), which are currently under negotiation. Funds for economic development are distributed to the provincial regions via the Regional Subsidiary Agreements. The agreement of greatest relevance to the peat industry has been the Northeast Subsidiary Agreement. The subsidiary Agreements receive 75 percent of their funding from federal sources and 25 percent from provincial sources. The Community Improvement Corporation (CIC) manages the provincially available funds. Various line departments, such as the Department of Natural Resources or the Department of Commerce and Development submit project proposals requiring funding under the agreements to the CIC where they are assessed. If approved, the proposals are forwarded to DREE where they are subject to the same process. Following approval, funds are transferred to the Departments to carry out the projects.

Since 1978, the Northeast Subsidiary Agreement has been a major source of funding for all peat projects conducted by the Province. The following projects have received partial or complete support from the Northeast Subsidiary Agreement:

- maintenance and repairs of a peat-fired boiler in Lamèque (not in operation)

- peat utilization study - Industrial Uses of Peat of Northeastern New Brunswick

- Centre de Recherche et de Développement de la Tourbe - Peat Resaerch and Development Centre - University of Moncton, Shippegan Campus
- manufacture of peat coke
- access roads and rail connections for several northeastern producers
- a peat coordinator for the newly organized Peat Producers Association
- Peat Resource Evaluation Program
- completion of an EMR Feasibility Study for a Peat-Fired Steam Electric Power Station for NE New Brunswick
- development of Jiffy 7 - Jiffy Products Ltd.
- International Peat Symposium - 1982, Shippegan, New Brunswick
- feasibility study for burning solid wastes at Lamèque
- improvement of the fuel feed system of the Lamb-Corgate Burner

Other agreements have also provided funding for peat projects. The Mineral and Fuels Subsidiary Agreement financed the Peat Resource Evaluation Program in Northeast New Brunswick for $726,000 between 1976 and 1981. Funding from the F.R.E.D. agreements was used to finance an early study of the peat industry in 1972. F.R.E.D. funds were also used to install the peat-fired boiler at Lamèque. In addition, DREE has directly financed a very recent study carried out by the Provincial Distribution Advisory Service, to investigate the costs involved in the distribution of peat from the bog to the market.

2. New Brunswick Department of Commerce and Development

Horticultural peat moss production has been an industrial reality in New Brunswick since the 1940s. Although it is a small industry (employing up to 700 seasonal and 100 full time employees) it has considerable importance in Northeastern New Brunswick, where it is the second most important source of direct employment, next to fishing. The problems which are currently facing the industry will be discussed in greater detail in the section on Private Industry. These difficulties, all related to overproduction, are areas of concern which the Department of Commerce and Development must address when providing assistance to peat producers.

The approach which the Department has adopted regarding the New Brunswick peat moss industry is to encourage the development of secondary producers - producers of peat based products - and to discourage any further growth, for the present, of primary production capacity. This is considered to be necessary due to the financial difficulties of current producers brought on by the overproduction of peat moss, a problem which the industry has had to contend with since it experienced a period of rapid expansion in the sixties and early seventies.

One of the first steps taken by the Department was to place limits on the eligibility of peat producers for financial assistance. The Policy, entitled Policy on Financial Assistance to Peat Producers, is included in the March 1982 Industrial Development Strategy for Manufacturing in New Brunswick. The Policy, which describes the conditions which must be met for the government to provide assistance to the peat industry, is provided below.

Policy on Financial Assistance to Peat Producers

- the Government does not provide financial assistance to new primary producers of peat moss who propose solely an extractive operation for peat to be marketed in an unprocessed form

- the Government first ensures that each new prospective primary producer is granted a peatland lease only on the evidence of an adequate development plan, new markets, and sufficient capital to bring the operation into full and regular production without financial assistance from the province

- the Government may choose to provide financial assistance on a selective basis to the following:

    - an existing primary producer who has been at least four years in proven economic operation to expand primary production for which a new market is assured

    - an existing primary producer undertaking secondary processing in New Brunswick

    - a new manufacturer to undertake only secondary processing in New Brunswick

    - a secondary processor in New Brunswick undertaking primary production as required to fulfill his own specific raw material requirements for the manufacturing process

- the Government places financial assistance priority on in-province secondary pocessing that sustains year round employment and creates highest added value

- the Government encourages secondary processing facilities to locate in proximity to the primary source

The industry is dominated by three larger producers and a number of small, family operated businesses. There is only one secondary manufacturer in the Province. Should they wish to do so, larger producers could support independent research into product development and market surveys. However, the small producers do not have this capacity and are dependent on government sponsored assistance in the areas of market research and product development. Thus, the main involvement which the Department of Commerce and Development has had in the peat industry has been to initiate, manage and support market studies and product development research. This work is carried out on contract.

In 1980, the Department commissioned a study, on the industrial uses of peat. The uses which were identified as being practical for the province to develop included:

- peat coke
- activated charcoal from peat
- peat as a fuel source
- peat as an oil absorptive

These products are now the subject of R&D being carried out on contract, largely by university researchers.

With the market studies complete and laboratory development and testing underway, the Department is now soliciting interest from various industries to test or use the peat products. Possible industries which have been identified include cement producers who would use fuel peat to fire the cement kilms, steel producers and tire manufacturers who could use peat coke to strengthen their materials, soft drink industries and sugar refineries, who could use activated charcoal for filtering systems.

However, two basic areas have been identified by the Department as requiring further development before these new products would have any opportunity for success: mining techniques and transportation. The New Brunswick producers are currently established to mine peat moss. The techniques used may or may not be applicable to mining the peat for secondary processing purposes. This has yet to be established. Peat is an expensive commodity to transport. The potential users are not located near the areas of peat production (in the Northeast), so that an economical means of transporting the product will have to be found. Clearly if the peat has been processed into peat coke or activated charcoal, this should not be a problem, providing the secondary processor is located near the harvesting site. Depending on its form, transporting fuel peat would present the greatest problem. It is therefore essential that the processor be encouraged to locate in the peat producing region.

3. New Brunswick Energy Secretariat

The Energy Secretariat was established in 1978 to manage the Federal-Provincial Conservation and Renewable Energy Demonstration Agreement (CREDA) for the province. The greatest emphasis was placed on developing wood energy. Peat energy was not an important element of the CREDA program. However, one fuel peat demonstration project was approved.

$1.3 million were made available to test burn peat at Jiffy Products N.B. Ltd. in Shippegan to produce heat and steam. The peat was to be burned in a wet cell burner, designed by Lamb-Cargate Industries Ltd. of British Columbia. The original design was intended for wood chips and hog-fuel and modifications were necessary before fuel-peat could be used. The main modification has been to the fuel-feed system. This work was financed under the Northeast Subsidiary Agreement. Experimental tests have been financed by the Federal Department of Supply and Services, National Research Council, the province of New Brunswick and Lamb Cargate. The actual demonstration project has been scheduled to take place during FY 1984/85, making use of the remaining CREDA funds.

The Secretariat has indicated that, given the considerable information available and the extent of the resource, fuel development projects could be considered under the new ENERDEMO agreements currently being negotiated. Possibilities exist in burning peat to produce heat and steam in fish processing plants in N.E. New Brunswick. This would take advantage of the resource being located in the same region as the main fish processing activities. If fuel peat is considered to be a new product, this would also satisfy one of the objectives of the Department of Commerce and Development and the Community Improvement Corporation to encourage industrial uses of peat.

4. Department of Natural Resources Mineral Branch

The Mineral Development Branch of the Department of Natural Resources has been responsible for carrying out the New Brunswick Peat Resource Evaluation Programme - the most comprehensive peat inventory available in Canada. The programme was initiated in response to a recommendation made at the end of an earlier Department of Regional Economic Expansion (DREE) agreement, that a management strategy should be established for the peat resource in the province. The first phase of the evaluation began during 1973/74 with an airphoto survey of the peat resource. The purpose of the survey was to locate and classify the peatlands in the province on the basis of surface vegetation. This first phase was managed by the Branch, but carried out on contract, with joint funding from the Departments of Commerce & Development, and Natural Resources.

All aspects of the Evaluation Programme were subsequently taken over by Department of Natural Resources - Mineral Development Branch, and detailed field surveys were conducted on all peatlands greater than 25 hectares in size during field seasons 1975 to 1981. This information was compiled on computer tapes and all maps and reports were finalized between 1981 and 1984. The inventory programme was funded by the Canada Department of Regional Economic Expansion (DREE) and the Province of New Brunswick under a number of Federal-Provincial Agreements, including the Mineral and Fuels Subsidiary Agreement and the Northeast Subsidiary Agreement.

Of the 140,000 hectares of peatland in the province, 132,000 hectares were surveyed in detail. Of those areas not surveyed, 4,500 hectares are in a National Park and the remaining 3,000 hectares were less than 25 hectares in size. The detailed inventory techniques used were those developed by the Geological Survey of Finland, modified for use in New Brunswick. The field methodology was transferred to New Brunswick during an exchange programme between Finland and the Province which operated between 1977 and 1980.

Detailed inventory information has been compiled on provincial, regional and site-specific levels. Site-specific information is available for each peatland surveyed in the form of base, isopach and elevation maps at a scale of 1:10,000. The maps are accompanied by information on the following:

- site location
- percent tree cover
- trophic level
- accessibility
- status of exploitation
- particulars on existing leases
- peatland area (total and greater than 1 meter depth)
- average depth volume and average humification of horticultural and fuel grade peat and overall deposit
- general survey information

Written descriptions are also provided, dealing with the general characteristics of the peatland, the distribution of peat types and humifications, surface vegetation, drainage characteristics, recommendations for potential use and a summary of chemical analysis information.

The purpose of this very detailed survey has been to supply information required to develop a multiple-use management plan for a particular site, or to support a long-term resource management program. The Mineral Development Branch considers that the information can be used for the following purposes:

- assessment of the potential of extracting peat for horticultural or fuel purposes

- selection of sites for "in situ" uses such as agriculture, forestry, wildlife habitats and conservation

- conducting engineering studies and/or academic research

c. Legislation Pertaining to Peatland Development

Peat and peat moss are defined as surficial deposits in New Brunswick and as such are subject to the regulations of the Quarriable Substances Act. Ownership of surficial deposits rests with the landowner. However, in New Brunswick, few peatlands were included with the original land grants and as a consequence approximately 80 percent of the peatlands remain as crown property under the administration of the Department of Natural Resources.

Companies currently producing horticultural peat lease all or part of their production areas from the province. Currently, 17 commercial producers hold leases for 10,480 hectares of peatlands. The conditions for obtaining and holding an exploration licence and lease were revised in 1979. All peat operations are now subject to the conditions established in the Crown Peat Resource Management Policy.

The Crown Peat Resource Management Policy is essentially a modified Quarry Permit and the resource is still subject to the general regulations of the Quarriable Substances Act. However, as is also now being recognized in other provinces, many aspects of the standard Quarry Permits are not appropriate for peat development.

Applications for a Peatland Exploration Licence or a Peat Production Lease are made to a Unit Ranger in the area where the peatland is located. The Unit Ranger evaluates the application and makes a recommendation to the Regional Resource Manager. The application is further evaluated by the Manager and is then forwarded to the Mineral Resources Branch. The application is reviewed by an Interdepartmental Peat Committee, comprised of the Department of Natural Resources, Department of Commerce and Development and the Community Improvement Corporation which convenes for the purposes of licence and lease reviews. In the case of an Exploration Licence, the evaluation assesses the proposed development in terms of the market impact of the new development. Particular concerns include the capability of the applicant to finance the exploration and development of the project, the marketability of the product, and the impact of a new development on existing producers. During the time that the applicant holds a licence, the applicant must assess the amount and quality of peat in the proposed lease area, and must prepare and submit an adequate plan for bog preparation (drainage), mining and rehabilitation following abandonment. If the Interdepartmental Peat Committee is satisfied with the proposed development plan, a lease is granted.

The policy has introduced several financial requirements in order to discourage hoarding or under-utilization of the resource, and to reinforce the commitment to responsible development, mining and reclamation plans. These have included increased rental fees, royalties and the introduction of security deposits. The rental fee was raised from a modest $0.05 per acre per year to $2.50 per hectare per year ($1.00 per acre per year). Royalties were to start at $0.02 per bale in 1980 and to increase to $0.05 per bale by 1984.

To ensure that production, and particularly, abandonment plans are followed, a security deposit and a reclamation surcharge must also be payed. The amount (up to $5,000, exclusive of interest) is refundable on abandonment, provided that appropriate rehabilitation measures have been met. If not, the deposit is applied to rehabilitating the area.

The responsibility for establishing a management plan rests with the developer. The Department of Natural Resources has not, as yet, established peatland development guidelines, nor has it proposed an integrated management scheme for major peatland areas, although, as previously indicated, this is planned for the future.

The policy is relatively weak with respect to environmental guidelines for peat development. The original Peat Resource Evaluation Programme concentrated on obtaining inventory data which would be valuable for assessing development potential. Data which would be necessary for any environmental assessment were not collected. Such information requirements would include baseline data on water quality, wildlife utilization, and the hydrological significance of the bog to the region. This is recognized as an aspect which needs further work and would fall within the jurisdiction of the Department of Environment.

The Department of the Environment has had very little involvement with the management of the province's peat resource. The Department is a member of the Land Management Environment Committee, chaired by the Department of Natural Resources with additional membership from the Departments of Transportation, Municipal Affairs, and Tourism. This committee reviews quarry applications. However, the representatives are not members of the Interdepartmental Peat Committee which reviews permits for peat exploration licences and leases. Their main involvement is related to their responsibility to enforce the Water Quality Act which stipulates that any new development requires a permit for Water Course Alteration. There are, however, no regulations which are specifically designed for peat development and the specific, unavoidable water course alterations inherent in this type of development.

v) Québec

a. Overview

In the late 1970s and early 1980s, the Ministry of Energy and Resources (Energy Division) and Institute de Recherche d'Hydro Québec and Hydro Québec were interested in developing large-scale electricity producing facilities fueled by peat. By 1981, however, the above groups and Centre de Recherche Industriel du Québec (CRIQ) agreed that they should shift their research emphases to energy production for heat from biomass material in general (including peat).

The Mining Division of the Ministry meanwhile has been involved in an ongoing horticultural peat inventory since 1965. The Division is currently considering the use of Landsat data to conduct a first level inventory of the peat resources of Nouveau Québec.

Quebec has the largest number of horticultural peat producers in Canada. Although both New Brunswick and Québec producers are suffering from the same marketing problems - overproduction and unstable, low prices, the Québec government has not developed the same strategy as New Brunswick of discouraging new primary production by restricting financial assistance to secondary producers only. It does however, recognize a need to develop new products.

b. Major Actors and Initiatives

1. Energy-Related Agencies

In Québec, the Ministry of Energy and Resources (Ministère de l'Energie et des Ressources) has the jurisdiction, development and management responsibilities for peat. The Ministry is organized into three divisions: Forestry, Energy and Mining. The Energy Division and Mining Division have been the most active in peat and peat-related programs. In addition, a number of government crown corporations have also been involved, almost exclusively in the energy aspects of peat. These crown corporations include IREQ (Institute de Recherche d'Hydro-Québec); Hydro Québec; CRIQ (Centre de Recherche Industriel du Québec); Nouveler - a Hydro Québec subsidiary company.

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Peat as an alternative energy source has been of appreciable interest to Québec since 1978. Hydro-Québec was the first of a number of government agencies and crown corporations to become involved in peat-energy activities. In 1978-79, Hydro-Québec commissioned a study of the technical feasibility of constructing and operating a 268 MW peat-fired generating station, and preparing, developing and operating a 1.3 million ton peat mining operation in the Lower St. Lawrence River Valley and the Lac St-Jean region of the province. The study indicated that the peat reserves in the Lac St-Jean region alone could support a 200 MW power plant. This was followed in 1980-81 by a detailed survey of 20,000 hectares of peatlands in the Lac St-Jean region to determine their potential for use as a fuel resource. The project has not, however, been developed any further.

Between 1978 and 1984, Hydro-Québec, IREQ, Ministry of Energy and Resources - Energy Department and Nouveler were involved in the development of the Anticosti Island peat gasification project. The location was recommended by Hydro-Québec as being suitable because of 1) the local availability of peat and 2) the region's dependence on the use of oil-fired diesel generators for electricity production. Due to changing priorities in the Québec energy situation, however, the project was never completed and the plant never constructed. The current status of the project is unclear. Hydro-Québec - identified as the sponsor - discontinued its involvement in the project. The Energy Department has expressed some interest in resurrecting the project, but how or for what purpose is not certain. Nouveler, the Hydro-Québec subsidiary responsible for developing the technology for the gasification plant, has since been looking for a market for its technology. Continuation of the Anticosti project would satisfy that market, but this is unlikely to occur in the near future.

In late 1981, la Direction des programmes d'énergies nouvelles (DPEN) - Ministry of Energy and Resources, l'IREQ, Nouveler and le CRIQ agreed on the need to establish objectives for the use of biomass energy sources - forest residues and peat - in the province. To achieve these objectives, responsibilities were allocated as follows:

- Nouveler should identify the potential markets for biomass energy in Québec and abroad (including other regions of Canada)

- IREQ and CRIQ should develop R&D programs for the most promising areas of utilization

- the government should establish policies concerning the use of biomass energy

During 1982-83 le CRIQ studied the current level of peat utilization for energy production world-wide and reported on the various policies concerned with biomass energy utilization. The situation in Québec was reviewed and the following conclusions were reached:

- a systematic and complete inventory of the province's peat resources would be necessary before a rational policy could be established

- development of an energy utilization policy was needed that would take into account the available resources and the distribution of regional and national energy resources.[14]

One factor identified as essential to defining the future direction of peat energy development, was the readily available supply of cheap hydro-electric power in the province. (In fact, Québec is currently producing surplus electricity.) In view of this, it was considered to be pointless to encourage the use of peat for the generation of electricity. Instead, it was concluded that the use of peat as a solid fuel for heating purposes held greater potential. Upgrading the fuel through gasification, liquefaction or compression would be possible R&D areas.

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[14] H. Caron et al, Revue Mondiale et Canadienne des Ressources de la Biomasse Tourbe et des Politiques d'Utilisation Energétique; Inventaire des Tourbières au Québec. (Sainte-Foy: Centre de Recherche Industrielle du Québec, 1983).

Interest currently exists in developing technologies that can be used for biomass energy. The Energy Department - Direction des programmes d'énergies nouvelles - is now promoting the development of technologies such as liquefaction and gasification which can be used for a variety of biomass products, including peat. The Energy Division is involved in a joint venture with Nouveler and Canertech to develop a gasifier. The gasifier will have been built by mid-summer 1984 and will be tested using a variety of biomass feedstocks. Testing should be completed by the end of 1985. Interest is currently moving away from peat in favour of forest residues and wood chips - both of which are readily available and require very little pretreatment and special handling. The Department is currently preparing an R&D policy for peat energy which should be available in the near future.[15]

Although the recent energy activities at least temporarily intensified a significant interest in peat, the Ministry of Mines and Energy - Mining Division, has been involved in an on-going in-house peat inventory program since 1965. Because the inventory was established to assess the extent of the horticultural peat resources in the southern part of the province, it has not been useful for assessing the fuel peat reserves. (At the time it was established, fuel peat was not an issue - and would not be for the next 15 years - but the horticultural industry was expanding.)

The inventory is based on airphoto interpretation and field sampling of selected sites. From the 1960s to the mid-1970s, peatlands in the populated regions of the province (predominantly in the St. Lawrence lowlands) were located on airphotos, and the surface peat layers - the horticultural grade peat - were sampled. This sampling was usually less than a meter at each site. Generalized notes were made on the surface vegetation. After 1977, a more detailed methodology was adopted. This involved more detailed mapping from airphotos and a more detailed sampling program of selected peatlands greater than 100 acres (40 hectares). The study sites are described according to: surface vegetation; profile; depth; peat type (primarily the composition of the peat moss); and degree of humification. Some chemical analyses are also being conducted (e.g. pH, available nutrients, ammonia), but few physical properties are studied. Peat volume is estimated from the deposit area and depth. The information is mapped at a scale of 1:20,000 and maps at 1:250,000 have also been compiled.

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[15] M. Georges B.B. LB, letter - 24 July, 1984.

The inventory was concentrated in southern Québec and was not extended into the Québec-Labrador peninsula - Nouveau Québec - an area of extensive, but largely inaccessible peatlands. La Société d'Energie de la Baie James did carry out a classification of the peatlands located in the southern part of the James Bay area as part of the pre-project planning for the NBR (Nottaway, Broadbeck and Rupert Rivers) Hydro-Electric complex. This has provided the only information currently available on the extent or nature of the peatlands of Nouveau-Québec.

The Mining Department is now considering the use of Landsat data to conduct a first-level inventory of the peat resources of Nouveau Québec. The mapping system developed by the Ontario Centre for Remote Sensing for the Ontario Geological Survey Peat Inventory Program is of particular interest to the Department at this time.

The Mining Department's Service analyses commerciales et projets industriels recently began to compile monthly statistics on peat production which are distributed to each producer on request. The statistics do not include information on the quantities sold by each producer. The Service also commissioned an earlier market study for new peat products (published in late 1983), but little has been done with this information since product development is left to the industry. The Service has, however, indicated that it would be within the jurisdiction of the Industrial Mineral Sector to accept and finance projects to develop new products from peat.

c. Legislation Pertaining to Peatland Development

In Québec, peat is defined as a quarriable substance under the Mining Law - Loie Sur Les Mines, Chapter M-13, and is referred to as an organic fossil material. For taxation purposes, peat is an industrial mineral. The Mining Department is responsible for the disposition of peat on publically-owned lands. However, most of the peatlands in the populated region of the province, particularly the St. Lawrence Lowlands, are privately owned - especially those areas suitable for horticultural peat moss production. Peat operations on privately-owned lands do not require a permit or licence. As a consequence, the majority of the province's current peat producers do not require a lease for their operations. When a peat area on public land is to be developed, the applicant must first obtain a Prospecting Licence. A lease is granted if the following conditions are met:

- the development is shown to be economically viable - including the results of a feasibility study; estimated level of production (and) cost of production
- approval is given from the Ministry of Agriculture indicating that the development is free of conflict with agricultural land use
- approval is granted from the Ministry of the Environment

Leases are long-term (20 years), being renewable on request three times for 10 years each, up to a total of 50 years. There are no guidelines concerning development requirements or rehabilitation following development. The Ministry of the Environment did carry out an earlier study concerning the environmental impact of peat production on peatlands bordering harvested areas but the report was not released and guidelines for recommended protection measures have not been developed.

All land in southern Québec has been classified according to its agricultural capability and value and its use is subject to the provisions of the Act to Preserve Agricultural Land. As a result, mining is prohibited on much of the land in Québec's agricultural regions. Peat harvesting is in conflict with agricultural use and therefore site selection and location decisions are governed by this Act.

There is no interministerial committee to review the applications.

vi) Ontario

a. Overview

Ontario has vast peat resources. Of the estimated 27 million hectares of land covered by peatlands, more than 90 percent occurs in northern Ontario. The Hudson Bay/James Bay lowlands account for the most extensive areas of peat, but very large peatlands exceeding 1,000 hectares in size occur throughout the northern part of the province. Although wetlands have been a topic of interest and controversy for many years in Ontario, peatlands as a separate wetland type have received significant attention only since 1980. The recent interest and activity was motivated by the global energy crisis, and the vast majority of all peat and peat-related projects recently completed or currently underway in the province are directly associated with the general theme of evaluating the energy potential of the province's peat resources.

In 1979, the Ontario Ministry of Energy established a new energy security target for the province in support of the Federal government's goal of crude-oil self-sufficiency by 1990. The policy, Energy Security for the Eighties: A Policy for Ontario, September, 1979, identified a number of targets for 1995, among which were the following:

- Ontario would produce 37.5 percent of its primary energy sources from within the province
- 5 percent of the total primary energy requirements would be produced from renewable and recoverable energy sources
- conservation and substitution would aim at reducing the growth in energy requirement from 2.3 percent per year to one percent per year

The strategy also stated the commitment to satisfy one percent of the provincial energy requirements with peat.

Initial interest in the fuel potential of peat was high, and this momentum carried through until 1983 at which time when oil prices once again began to decline. Peat has not yet seen the development initially envisaged, but the early momentum generated by the energy crisis resulted in a number of projects being initiated.

The Province's peat and peat-related activities include a five-year peat resource inventory; socio-economic investigations concerning fuel peat development; market studies; technical investigations and basic research. These projects are supported through the BILD (Board of Industrial Leadership and Development) Energy Initiatives, including the Hydrocarbon Energy Resources Program (HERP) and the Alternative Transportation Fuels Program (ATFP).

A number of ministries and their agencies have been involved in various aspects of peat and peatland development. Those most actively involved include:

- Ontario Ministry of Natural Resources (OMNR)
    - Ontario Geological Survey (OGS)
    - Wildlife Branch
    - Land Management Branch
    - OMNR-Northern Region

- Ministry of Energy

- Ministry of Northern Affairs

- Ontario Centre for Remote Sensing (OCRS)

Other ministries involved in a less direct manner include:

- Ministry of the Environment
- Ministry of Agriculture and Food
- Ministry of Industry and Trade

Provincially-sponsored research and development projects concerning the energy applications of peat have been sub-contracted to the Ontario Energy Corporation.

The province has also formally established an Interministerial Peat Committee (March 1984), comprised of representatives of each of the three ministries most closely involved with peat development:

- Natural Resources
- Energy
- Northern Affairs

The committee is chaired by the Ministry of Natural Resources and has a full-time secretary-administrator. The committee will sit for an initial three year period (until March 1987). At the end of this period its future responsibilities, if any, will be determined.

b. Major Actors and Initiatives

1. Ministry of Energy

Energy from peat has been the issue which has promoted the very sudden growth in peat-related activities in Ontario since 1980. The Ministry of Energy has been instrumental in supporting this through its interest in the development of what it anticipates is a very large, indigenous fuel resource.

In addition to working in close association with the Ministry of Natural Resources and the Ministry of Northern Affairs on many projects, the Ministry of Energy has commissioned a number of studies and projects investigating both the economic and technical feasibility of peat development in the Province. Included have been:

- investigations of the energy and non-energy potential of peat (An Evaluation of the Potential of Peat in Ontario, MONENCO, 1981 - jointly funded with the Ministry of Northern Affairs and Ministry of Natural Resources)

- Peat in Ontario, A New Awakening for an Old Fuel: a brochure providing background information on the fuel peat resource

2. Ministry of Northern Affairs

In Ontario, peat is considered to be a largely northern resource. As such, the Ministry of Northern Affairs has partial responsibility for managing the development of peat in the northern regions of the province.

The Ministry does not have a clear mandate to carry out Research and Development and is therefore dependent on other Ministries in this respect. At most, its responsibilities are to provide access for Northern people to government programs - a liaison service - and to advocate development of natural indigenous resources in the north. Because of the very northern aspect of the peat resource, and the employment opportunities its development could provide (i.e. the social and economic benefits), the Ministry of Northern Affairs has expressed considerable interest in peat. However, the Ministry is not in a position to financially support peat development, and can only advocate that other ministries become involved in peat development.

The Ministry has supported several studies which could be interpreted as offering potential social and economic benefit. It was a partial sponsor of the MONENCO Report - The Potential of Peat in Ontario. The Ministry also commissioned a study dealing with the use of peat as a chemical feedstock and its value in the agricultural industry. It was also a co-organizer and sponsor of the Thunder Bay Symposium in 1981, "Peat: New Awakening for an Old Fuel". Most funding which would be available for Northern Affairs-sponsored peat studies would come from the Northern Ontario Rural Development Agreement (NORDA). However, peat is currently very low in funding priority and the Ministry will most probably have to rely on projects funded by other ministries. The Ministry is a member of the Interministerial Committee on Peat and will most probably take on a strong advocacy and implementation role, promoting peat development in Northern Ontario.

3. Ministry of Natural Resources

Of the three ministries most closely involved with peat, the Ministry of Natural Resources (MNR) has the broadest disciplinary interest. Since it is the general mandate of this Ministry to manage provincial resources, peatland inventories, evaluation and regulation of development are the responsibility of the MNR. At least three Ministry branches and one region (probably more) are currently involved with peat or peat-related projects:

- Ontario Geological Survey (OGS) - Peat Inventory Program
- Land Management Branch - Disposition of Peatlands
- Wildlife Branch - Wetland Evaluation Program
- OMNR-Northern Region - Operational Forest Drainage in Peatland Black Forest Stands in Northeastern Ontario.

Peatlands (or wetlands) are also of interest to the province's Conservation Authorities (which receive partial funding from MNR) for their hydrological value - particularly for water retention and flood control.

4. Ontario Geological Survey (OGS) - Ministry of Natural Resources

The Ontario Geological Survey (OGS) is currently managing the Peat Inventory Program, a program which was established to evaluate the extent of the fuel peat resource in the Province. The Program, which began in 1981/82 and is to be completed by March, 1986, is part of the Hydrocarbon Energy Resources Program (HERP) - funded through the BILD Initiatives Program. Peat is one of four energy sources which the OGS has been evaluating under this program; the other three include oil shales, lignite and conventional oil and gas. The Hydro-Carbon Energy Resources Program has been allocated $10 million over the past four years to carry out these resource evaluations. The Peat Inventory Program is managed in-house, but the inventory work has been awarded on contract to a number of consulting firms. The objectives of the inventory are to establish a first-level inventory of the peatlands in the province and a detailed inventory of peatlands in selected study areas.

Ontario's extensive peatlands occur primarily in Northern Ontario. They are largely inaccessible and far from potential markets. For this reason Ontario has chosen to conduct a selective survey. The peatland inventory is being carried out on two levels. All peatlands in the Province are being mapped at a reconnaissance level using remote sensing techniques, primarily the Applicon mapping system developed by the Ontario Centre for Remote Sensing for applications to wetlands mapping. The information contained on the resulting maps aids in the selection of peatland areas which warrant more detailed investigation. Selection is based on the suitability of an area for future development. Preference is given to those regions located close to markets and existing transportation facilities (rail or road). An area may also be selected if requested by a regional manager, or if the survey may be incorporated into other OMNR studies. The peatlands are evaluated in detail using field and laboratory methods similar to those already used in Finland and New Brunswick.

Results of the surveys are available as OGS open file reports. The map set for each report includes an index map of the study area (1:250,000), peatland classification maps based on the airphoto interpretation (1:15,840), field maps, isopach and elevation maps (1:15,840) and profiles (1:4,000). Information on area, depths, humification and volumes are also tabulated. This is accompanied by written descriptions of the peatland characteristics, vegetation types, peat type distribution, humification, drainage and utilization potential.

Reports are now available on the investigations of the first two field seasons (summer 1982 and 1983). Eleven areas were studied in detail (five in central and eastern Ontario and six in Northern Ontario). Five additional areas have been investigated during the most recent season. The survey will continue for one more season (summer 1985) and all reports will be completed by March 1986.

Based on the currently available information, OGS has identified at least one region which shows potential for either future development or a demonstration project. The Fort Frances/Rainy River area is well situated for transportation and market access (being located on Lake Superior), has extensive peatlands, and is located in the same physical and climatic region as the Iron Range of Minnesota, where fuel-peat development projects will be demonstrated. One other area has been considered in the past as the site of a future demonstration project and has been studied in some detail. Galbraith Bog, near Sault Ste. Marie, Ontario was investigated for its potential to supply both horticultural and fuel-peat to the MNR forest nursery in the northeast region. A production plan for the site was completed and a ditching program was carried out but the project is currently dormant and it is not anticipated that it will be developed further in the near future.

The Peat Inventory Program is scheduled for completion at the end of the Hydrocarbon Energy Source Program in March 1986. By that time OGS feels that all priority areas will have been studied and a first-level inventory of the province's peat resources will be available. The direction which the Program will take following March 1986 is not known. OGS has indicated that they will apply for funding for a second 5-year period, but funding will most probably be allocated, once again, from external funding sources. Thus, it does not appear likely that peat will be incorporated into the OGS internal program structure in the near future.

5. Ontario Centre for Remote Sensing

The Ontario Centre for Remote Sensing (OCRS) has been involved in the application of remote sensing techniques in the study of wetlands and wetland classification. The most extensive work has involved the development of the Applicon computerized mapping system. The system is based on the use of Landsat digital data and has been used to produce a series of wetland classification maps (1:250,000) of the Hudson Bay/James Bay Lowlands. Wetlands are classified according to the reflection values of their surface vegetation. Ontario has been the first province to make such extensive use of remote sensing methods in its peat inventory. Nova Scotia has adopted the techniques for its inventory and Alberta has also shown considerable interest in the mapping system. Quebec may also elect to use this technique to map the very extensive peat areas in Nouveau-Quebec. This mapping program has also been integrated into the joint studies being carried out by the OMNR-Northern Region and the Great Lakes Forest Research Centre - Canada Forestry Service in the Clay Belt of Northern Ontario.

OCRS develops remote sensing techniques to be used at an operational level, as in the current Peatland Mapping Program. These techniques are developed in response to the needs expressed by other government departments or agencies. Refinement of the Peatland Mapping Program will continue as long as the requirement for a more refined technique develops.

6. Interministerial Committee on Peat

The Ministries of Natural Resources, Energy, and Northern Affairs have collaborated closely on many of the peat studies and projects outlined in the preceding sections. Since 1980, these projects have been coordinated through an informal, ad hoc committee. As interest in peat grew rapidly (particularly from 1980 to 1983), it was recognized that a formal vehicle would be necessary to provide program structure to the numerous studies and projects if they were to continue as multi-disciplinary efforts. In addition, a central coordinating agency could deal more effectively with the growing public interest in peat, replacing the confusion which typically arises in such situations involving a number of different agencies with different responsibilities and interests.

The Interministerial Committee on Peat was established in March, 1984. The committee is composed of a permanent representative from each of the three ministries most closely involved with peat development in Ontario:

- Ministry of Natural Resources
- Ministry of Energy
- Ministry of Northern Affairs

Representatives of other ministries, such as Industry & Trade, Environment, Agriculture & Food will also join the Committee on a temporary basis when issues specific to their areas of responsibility arise.

Since the Ministry of Natural Resources has the broadest disciplinary interests in peat and is responsible for resource evaluation, development and management, the committee is chaired by the member from this Ministry. The committee is served by a full-time secretary/administrator and clerical assistance is provided by the Ministry of Natural Resources. Funds for the administrator are supplied by the OMNR.

The committee will be constituted initially for a three year period. Annual reports will be submitted to each of the three Deputy Ministers and, prior to the end of the three-year period, the committee will undergo a Deputy Ministerial Review.

The committee is currently establishing its detailed three-year program, the primary goal of which will be to stimulate and assist the development of the province's peat resources.

The committee's objectives for the next three years are to:

- identify the requirements for peat development in Ontario

- identify gaps in the knowledge of peat and its uses in Ontario, with due regard to the above requirements for peat development

- define medium and long-range program targets and development opportunities

- direct available funds and seek funds to ensure efficient and effective encouragement of peat resource development

- provide a focal point within the provincial government for peat-related matters and allow a "one window" approach to public and private sector inquiries

- facilitate effective liaison on peat-related matters between the provincial government and other government jurisdictions and the private sector

The committee does not have its own operating budget. Funding for projects recommended by the committee will be requested from the Ministry or Ministries with the greatest interest or responsibility for that particular field of study. Funding may be provided internally or may be available through BILD or from appropriate Federal-Provincial Agreements such as ENERDEMO or the Mineral Development Agreements.

Although a program has not yet been finalized, the committee has identified a number of issues and projects which are of interest to the committee. These include:

- encouragement of peat development in Northern Ontario (the Fort Frances area has been identified as the most promising area to date)

- development of sequential land-use planning for peatlands

- the study of combustion characteristics of Ontario peat

- investigation of the environmental effects of peat mining and processing

- identification, development and promotion of new peat products or derivatives for the forestry and chemical industries

- examination of the potential of Ontario-based manufacturing of peat mining and processing equipment

All of the projects carried out prior to the formal organization of the committee will provide valuable background information on which to develop further programs.

The committee is limited in its capabilities, in that it cannot directly implement peat programs - it may only promote and coordinate projects which must then be approved and implemented by the various ministries involved. The committee will assume a largely advisory role. Its most important function will be to provide a focal point for peat and peat-related projects and to disseminate information to the public or other government agencies. It also hopes to be able to resolve the development conflict between a myriad of competing interests such as fuel and horticultural development, agricultural use and wetland policy issues (including environmental and fish and wildlife concerns).

c. Legislation Pertaining to Peatland Development

The policy regarding crown land Peat Disposition is currently being revised in Ontario. The disposition policy is described in a number of policy and procedure directives prepared by the OMNR Mining Lands Section, Land Management Branch and issued to all regional and district offices. The current procedures are intended to be used as guidelines only. Although the procedures have been in place since December 1981, the new policy is still awaiting final approval in the Ontario Legislature.

Peat management policy in Ontario has historically been concerned with horticultural uses, and the uses of peatlands have required a land-use permit issued under the Public Lands Act. The right to extract peat as well as other surficial materials such as marl, sand and gravel require the staking of a claim under the Mining Act.

Release of land for mineral extraction under the Mining Act is a two-phase process. The first is an exploration and evaluation phase requiring either 1) the staking of a mining claim or 2) an exploratory licence of occupation. During a limited period of time, the developer must evaluate the economic potential of the deposit, but may not remove the material for commercial purposes. The second phase is the mining phase, which requires a mining lease. Revenue to the province is payed through the tax on profits of the mining operation on either leased or private land.

The Quarry Permit is an exception to this two phase disposition process. A quarry permit is valid for one year, but may be renewed on a yearly basis. A yearly rental fee and royalties on the material removed is payed to the crown. In February, 1981, the Mining Act Section 60(3) RSO 1980 was amended so that peat was also exempted from staked mining claims and was to be considered as a surficial material subject to the regulations of the Quarry Permit, although still considered to be a mineral under the Mining Act.

In accordance with the new policy, "All applications for peat exploration and or extraction must be reviewed from the standpoint of their impact on existing land uses, Ministry Programs, and the Environmental Assessment Act, MNR Exemption #26. Trade-offs favourable or unfavourable towards peat extraction should be made only as a result of the above comprehensive review." (Land Management Branch, Mining Lands Section, Policy Directive No. LM5-09-00, December 23, 1981).

Any proposal for peatland development must clearly state the intended use of the operation. For the purpose of application review, the land-use must be identifiable as one of the following (defined by the Procedure Directive LM 5.09.01. Mining Land Disposition - Peat Disposition "Integrated Review of Proposals", July 31, 1981):

I Renewable Resource Production, including agricultural production and forestry, and for growing crops that may be converted into various forms of energy (biomass production which includes horticultural peat moss production);

II Non-Renewable Resource/Extraction, to produce peat for fuel in various forms; as a raw material for industrial chemicals such as peat coke, waxes and steroids, etc., as a filter medium for mineral extraction processes, and as an oil spill controlling material or peat moss for horticultural purposes;

III Peatland Preservation, may be appropriate in order to protect portions of these lands which may have either scientific value, unique natural sytems, recreational value, historical or aesthetic importance or which may provide a resource base important to future generations. The use of peat bogs in tertiary treatment of sewage is also included in this category, as are water quality and hydrological control uses not involving mining of peat

The purpose of identifying the initial land-use is to allow the Land Management Branch to assess the development in terms of the land-use planning process, including the environmental review process. The District Manager is instructed to carry out an assessment of potential land-use conflicts against a recommended check-list. The proposed development must not be in conflict with any of the following, existing land-uses identified by the Procedures Directive LM-5-09.01 Mining Land Disposition - Peat Disposition "Integrated Review of Proposals" July 31, 1981:

1. International Biological Program Designation

2. Candidate Park

3. Existing Land Uses (Ministry Objectives)
   a) Wildlife Production Area
   b) Timber Production Area (currently contributing to allowable cut)
   c) Existing Licensed Trapline
   d) Traditional Indian Land Use (Indian burial ground)
   e) Existing Wildrice Production Area
   f) Existing Habitat of Endangered Species
   g) Existing Commercial Bait Fish Operation
   h) Existing Transportation or Communications Corridor, particularly pipelines

4) Headwater Storage Area

5) Groundwater Recharge Area

6) Potential Agricultural Area

7) Compatability with plans of other governments or agencies e.g. official plans, zoning by-laws, etc.

If a conflict exists, the proposal is initially turned down. The Ministry may thereafter judge in favour of exploitation over the existing land-uses if a cost/benefit analysis results in a trade-off in favour of peat extraction. Thus an initial land-use conflict does not preclude development.

Once all factors are satisfied, (i.e. land-use conflicts; cost/benefit analysis; assessment of long and short term environmental impacts according to the Environmental Assessment Act; a statement outlining residual land use plans) disposition of peatlands is allowed. If the land-use is renewable resource production (including peat moss extraction) disposition occurs under the Public Lands Act. If non-renewable or preservation is intended then an interim disposition is granted under the Mining Act.

As it is currently organized, there are now four disposition mechanisms for peat in Ontario.[16] These reflect the intended land-use.

1. For removal as horticultural peat, disposition will be by land use permit, under the Public Lands Act, with an attendant yearly permit fee of $25.00, and royalty payments of 5 1/2¢ per 100 kg (2 1/2 ¢ per 100 lbs.) of peat taken.

   A land use permit is issued on a yearly basis, with conditions setting out specified use of the land and rehabilitation criteria.

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[16] Land Management Branch Ontario Ministry of Natural Resources, Peat Disposition Crown Lands (Toronto: O.M.N.R., 1981), p. 1.

2. For removal as fuel, where the applicant has a ready market, and knows the volume required and where it is, disposition will be by quarry permit, under the Mining Act, with a royalty fee yet to be determined.

   It is anticipated that this form of disposition will be limited to very small, personal-use proposals equivalent to programmes already established such as the crown fuel wood lot, where an individual may obtain firewood for personal use at minimal cost, or the quarry permit allowing an individual to take up to 378 m^3 (500 yd^3) of sand and gravel royalty-free, for personal use, from a designated area of crown land.

3. Where the applicant is developing markets, seeking a source and determining overall feasibility, permission to explore will be by exploratory licence of occupation with attendant conditions regarding reduction of original area normal to this type of disposition, carrying an issuing fee of $1,000 per year and bearing a "required annual expenditure" condition of $2.45 (Cdn) per hectare ($1.00 (Cdn) per acre) per year.

4. Where the applicant is developing markets, determining economic feasibility, and is prepared to apply for a specific bog of up to approximately 1,215 hectares (3,000 acres) in extent, permission to explore will be by quarry permit for testing purposes only, with waiver of royalty and scheduled fee of $10.00 for first 16.2 hectares (40 acres), plus 61.7¢ per additional hectare or portion thereof.

Wetland Policy

Prior to any interest in energy development, and still very much in the foreground today, has been the contentious issue of wetlands, including peatlands, and the controversy of wetland management in the province. Of primary concern is the loss of wetlands which has continued unabated in southern Ontario since settlement began. It is considered that 80 percent of the original two million hectares of wetlands have disappeared in southern Ontario due to drainage and infilling - land improvement measures practiced for the purposes of agriculture, commercial and industrial land development.

In March, 1984, the Ministry of Natural Resources released its long awaited *Guidelines for Wetland Management in Ontario*. (The Guidelines are presented in Appendix 4.)

The *Federation of Ontario Naturalists* has been an instrumental group in the process aided by a number of other private interest groups, including Ducks Unlimited (Canada), The Nature Conservancy, The Sportsmen's Fund, and others. In 1975, the Ministry of Natural Resources issued its first official statement regarding wetlands in which it accepted "the challenge of protecting wetlands and marshes" and indicated its plans to incorporate wetland policies into Official Plans, various pieces of legislation and the Strategic Land Use Plan. This was reiterated again in 1977 and, in 1979, a "Proposed Interim Wetlands Conservation Policy" was temporarily introduced.[17]

In 1980, an interministerial sub-committee was established to develop a wetlands policy for Ontario. The eight-member *Wetlands Policy Development Sub-committee* (a sub-committee of the Land Use Committee of the Cabinet Committee for Resources Development) was comprised of representatives from the Ontario Ministry of Natural Resources, Northern Affairs, Intergovernmental Affairs, Housing, Treasury and Economics, Agriculture and Food and the Environment.

After nine months of thorough study concerning numerous aspects of wetlands development, the sub-committee submitted its recommendations to the Land Use Committee of the Cabinet Committee for Resource Development. A modification of the recommendations appeared as a public *Discussion Paper: Towards a Wetland Policy for Ontario*, September 1981. The *Guidelines for Wetland Management in Ontario* are based on this Discussion Paper and the ensuing debate. (The original committee recommendations appear in *Ontario Wetlands Conference Proceedings 1981*.[18])

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[17] Ron Reid, "A Critic's View of Wetland Policies" in *Ontario Wetlands Conference Proceedings*, ed. Anne Champagne (Don Mills: Federation of Ontario Naturalists, 1981), p. 98.

[18] *Ibid*., pp. 92-106.

The development of these Guidelines are closely tied to the development and use of the provincial wetland evaluation system, An Evaluation System for Wetlands in Ontario South of the Precambrian Shield, second edition, 1984. In fact, implementation of the Guidelines is dependent on the use of this system. An introduction to the Evaluation System is also provided in Appendix 5.

Using this system, the Wildlife Branch (OMNR) is now conducting a Provincial Wetlands Evaluation Program. In its attempt to convince Ontario of the urgency for developing a set of wetland evaluation guidelines, the Federation of Ontario Naturalists produced a rating of their own which was based on a rating scheme developed and used in the state of Massachusettes. The Ministry was not satisfied with this scheme. The Wildlife Branch (OMNR) enlisted the help of the Canadian Wildlife Service (CWS) to develop a rating system which would be acceptable for use in the province. The first system was tested in the summer of 1982, and modified and further tested in 1983. The second edition of the system was accepted and was adopted as the Evaluation System which was released in 1984. The Evaluation System is a point accumulation system; by satisfying a number of criteria (and therefore accumulating points), the value of wetlands is determined, and the need for protection is determined. The Guidelines are weighted heavily toward conservation and concern has been expressed that they do not give equal consideration to the resource-development potential of a wetland.

Peatlands comprise two of the six wetland groups identified in the Guidelines and the Evaluation System, i.e. bog and fen (the others being wetland forest swamp, wetland thicket (carr), wetland meadow, and marsh and aquatic community). Their resource potential (in the developed form) is not incorporated in this system. As a result, a peatland which may have high resource potential as well as high conservation value would, in this scheme, be identified only as having a high conservation value. Understandably, this has led to controversy amongst the Ministry Branches with the Wildlife Branch and Outdoor Recreation Group advocating Conservation and the OGS, Land Management and Forestry Branch interested in resource development.

vii) Manitoba

a. Overview

Manitoba has a large peat resource, estimated to cover 38 percent (20,664,000 hectares) of the provincial land area. The most extensive areas occur in the largely inaccessible northern regions of the province - primarily in the Hudson Bay lowlands. Manitoba peatlands are used primarily in their undeveloped state. Black spruce for pulp production and local saw mills is taken annually from accessible peatland areas in the southeastern and central parts of the province. Agricultural development of shallow organic soil deposits has occurred over a number of years at the northern and eastern fringes of the present agricultural areas.

The land area south of the permafrost line has been divided into areas suitable for agricultural development and areas which can be recovered for agriculture. Recovery of land for agriculture is proceeding at a rate of several thousand acres per year. Wetlands, including peatlands, are being drained for agriculture. Wetland areas generally converted to farmland include sedge fens and their organic soils with a marl base and neutral pH. The Manitoba Peatland Farmers' Association works in cooperation with federal and provincial agricultural agencies in carrying out the progressive reclamation of wetlands. This group is also involved in developing special agricultural uses of peatlands such as wild rice production.

Industrial and horticultural uses of peatlands have developed on a small scale in southeastern Manitoba. Two producers are currently established in the province - Fisons Western, which has 4 bogs in operation, and Premier West - which has just acquired exploration rights. Ninety percent of current production consists of horticultural peat moss, primarily for the export market.

In spite of this activity, peat utilization has a very low priority and management has not been encouraged by the government.

b. Major Actors and Initiatives

1. Department of Energy and Mines

The Manitoba Department of Energy and Mines is responsible for managing the province's peat resources. Two Divisions have had some involvement in the past: the Energy Division and the Geological Survey Branch - Mineral Resources Division.

The Energy Division has conducted some preliminary economic studies on the manufacture of methanol from peat as an alternative transportation fuel using the syngas system. However, peat did not compare favourably with other fuel feedstocks and it was concluded that peat would not be used to manufacture methanol in the near future.

The Manitoba Department of Mines and Energy had an energy development agreement with the federal department of Energy, Mines and Resources - under The Remote Communities Development Program - but the use of peat as a fuel source in remote communities (not connected to the provincial power grid) was not investigated.

The Mineral Resources Division has produced some preliminary estimates of the province's peat resources. A study consisted of a detailed survey of numerous sphagnum bogs in southern Manitoba.[19] The study was carried out to provide valuable information on the horticultural peat moss resource in the southern part of the province. The work was funded through the Canada-Manitoba Subsidiary Agreement on Mineral Exploration and Development. Since 1980, the province has not investigated further either the total extent of its peat resources or the fuel reserves.

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[19] B.B. Bannatyne, Sphagnum Bogs in Southern Manitoba and Their Identification By Remote Sensing (Winnipeg: Manitoba Department of Energy and Mines, 1980).

Soil survey information showing the extent of organic soils in the province has been the basis of most estimates of peat in Manitoba. These surveys have been conducted by the Canada-Manitoba Soil Survey and the Geological Survey of Canada. The extensive peatlands in the Hudson Bay Lowlands have not yet been surveyed. Digital Landsat data inventory methodology is now being investigated at the Manitoba Remote Sensing Centre usng the Image Analysis Unit on loan from the Canada Centre for Remote Sensing. The study area is Le Pas, on the Manitoba/ Saskatchewan border. The objective of the project is to determine if digital Landsat data analysis could be successfully used to provide a reconnaissance of Manitoba peatlands. The system is essentially the same as that being used in Ontario.

c. Legislation Pertaining to Peatland Development

Peat is defined as a quarry mineral and is subject to the Quarrying Minerals Regulations, 1976 (Manitoba Regulations 226/76); Chapter M160 of the Mines Act. The regulations pertain to crown land only. There are no special disposition regulations for peat, nor are there any guidelines for development which might be appended to exploration permits and leases granted for peat development. Peat is also exempted from the rehabilitation requirements outlined in Part VI - Rehabilitation, sections 67 to 76. There currently does not seem to be an interest in establishing rehabilitation requirements following peat development.

viii) Saskatchewan

a. Overview and b. Major Actors and Initiatives

Peat studies in Saskatchewan began on a very modest scale in 1974/75 in response to a number of inquiries concerning horticultural peat and peat as a source of energy. The then Saskatchewan Mineral Resources Department concentrated its investigations in the Carrot River/Hudson Bay area where the province's only horticultural peat moss producer, Carrot River Peat Moss - a Saskatchewan Minerals Corporation - is now in production. This was followed by a reconnaissance program, known as the Fuel Peat Resource Program, which ran from 1977 to 1979. Its purpose was to study the distribution, quantity and quality of fuel and horticultural grade peat in a 200 km wide belt south of the precambrian shield, in north-central Saskatchewan. The increased costs of conventional energy sources in the remote communities of this region led to the interest in developing this program. In addition to the reconnaissance studies, an evaluation of the technical and economic feasibility of development and utilization was carried out and was completed in 1979. The study also established a priority for reconnaissance field investigation in the north-central part of the province.

A subsequent study, also carried out on contract, evaluated the engineering and economic aspects of developing bogs in the Buffalo Narrows Region of Northwestern Saskatchewan. The feasibility studies were managed by the Saskatchewan Geological Survey, Industrial Minerals Division and were funded through a Department of Mineral Resources - DREE Agreement (the Canada-Saskatchewan Interim Subsidiary Agreement on Mineral Exploration).

The results of these investigations eventually led to the Buffalo Narrows Fuel Peat Demonstration Project (discussed on pp. 57-59). The practical Demonstration Project began in the fall of 1981 and continued until August 1983. It was discontinued prematurely due to provincial budgetary restraints. The project was managed by the Saskatchewan Geological Survey, Saskatchewan Mines and Energy and was funded through the Canada-Saskatchewan Conservation and Renewable Energy Demonstration Agreement Program.

The emphasis of Saskatchewan's peat investigations has been entirely fuel oriented. With the conclusion of the Demonstration project, the attention has been drawn away from peat. Saskatchewan is particularly rich in fossil fuel resources (coal, heavy oil, lignite) and there is little indication at the moment that any further fuel peat investigations, or any other peat-related projects will be considered or implemented in the near future. Saskatchewan's large lignite reserves in the south of the province currently appear much more attractive for development.

The Saskatchewan Power Corporation, whose research interests are directed toward utility development and the generation of electricity, has little interest in seeing peat developed for energy purposes in the province. Any peat-related work of the corporation has been an extension of the corporation's research into alternative energy sources (particularly wood and lignite as well as gasification using these two feedstocks). The corporation's main concern with peat is to be in a position to assess the currently available technology when necessary. Therefore, little encouragement is coming for further development of any fuel peat programs.

With the exception of the Carrot River Peat Moss operation there are no other government agencies actively involved in peat.

c. Legislation Pertaining to Peatland Development

Jurisdiction of peat and peatlands is a somewhat unique situation in Saskatchewan. Peat moss comes under the jurisdiction of the Department of Agriculture while fuel peat is considered to be a mineral and thus comes under the jurisdiction of the Department of Mines and Energy. Being an agriculturally-based province, a considerable amount of land is under the jurisdiction of the Department of Agriculture. Where peat development might occur on this land, the Department of Agriculture must issue a lease for the removal of peat moss. If fuel peat is to be extracted, a second mineral lease is required from the Department of Energy and Mines.

ix) Alberta

a. Overview

Peat is a very new topic of interest for Alberta government agencies. Until the province has a reliable inventory of the resource it will not be possible for any responsible inclusion of peat in the land use planning and management scheme to occur. At the present time, the Province has not made a commitment to either studying the peat resource or to investigating its management or potential uses. It has however shown an interest in surveying the extent of the resource. Alberta also supports a small horticultural peat moss industry.

b. Major Actors and Initiatives

1. Alberta Energy and Natural Resources

. Land Division

The Land Division is concerned with the administration of crown land, and as such the administration of crown peatlands falls within its jurisdiction. There are three groups within the Land Division, all of which have some involvement or potential interest in the administration of peatlands. The Administration Group is concerned with the disposition of licences or leases, while Support Services supplies maps and conducts surveys or inspections. The Land Management Group determines the land use potential of the area and how development should be carried out or regulated.

Currently, the only peat development in the province has been a small horticultural peat moss industry. It has been left to potential developers to identify areas for development and to propose management plans. The Land Division has not yet investigated the potential uses for peatlands. Alberta does have a land use program administered by the Lands Division: the Integrated Management Plans (IMP) (also referred to as Integrated Resource Plans (IRP)) in which a number of land uses for a particular area are organized and integrated. Agriculture, forestry, fish and wildlife management or recreation are all identified as potential land uses for various land types. Peatlands, however, are generally identified only as peatlands and are not assigned a potential land use. Peatlands are therefore not incorporated into the Provincial Integrated Management Plans.

It is generally accepted that before any land use investigations can be considered, the nature and the extent of peatlands must be established through a resource inventory. A province-wide peatland inventory is now being considered by the Resource Evaluation and Planning Branch (see below).

- Resource Evaluation and Planning Branch

The Resource Evaluation and Planning Branch has established a pilot project being carried out on contract by the Alberta Research Council, to study the various peat methodologies currently developed and to recommend an appropriate methodology for an Alberta Peatland Inventory. This project was established in response to requests from the industry that peat areas and peat types be identified in order that the industry might be better equipped to plan for other potential uses in the future.

Prior to establishing the pilot study, the project was discussed in an ad hoc multi-disciplinary forum. The resource information currently available is only indirectly related to peat, and tends to be contained in soil surveys and inventories or wetland classifications and physiographic maps.

Although a small horticultural peat moss industry has been active in Alberta since the 1970s, there has been very little incentive from other industrial sectors to develop or investigate the resource. Peat is a very poor contender as an alternative energy source in Alberta and is not considered to have any significant agricultural potential in the province.

Some interest in peatlands has been shown in the forestry sector. The Forest Research Branch, Alberta Energy and Natural Resources has established a peatland forestry study (FY 1983/84) to monitor tree growth on a drained site and the Departments of Geology, Soils, Engineering and Forestry at the University of Alberta have established a four-phase forest drainage study which began in July 1981 and will continue until December 1985.

2. Alberta Research Council

The Alberta Research Council, Natural Resources Division, has carried out some minor peat studies in the past. The Soils Department, which has traditionally included peat as an organic soil in mapping programs, initiated a study in 1981 to look at the general characterization of peatlands, with an interest in mapping requirements. This Department is now conducting the Peatland Inventory Pilot Study for the Resource Inventory and Evaluation Branch, Department of Energy and Natural Resources.

3. Alberta Department of Agriculture

Alberta defines three levels of agricultural activity: primary (e.g. farming), secondary (refining) and tertiary (processing). Peat harvesting (or mining) (i.e. as it occurs in horticultural peat moss activities) is defined as a primary agricultural activity, and is therefore of some interest to the Department of Agriculture. The Agricultural Processing Development Branch has the responsibility of providing a liaison between the Department and the province's peat moss producers. Technology transfer is the main objective of this liaison. Acquiring or developing new or improved technology is promoted through the Technological Assessment and Improvement Program, which is available to the peat moss industry as well as the traditional branches of agriculture.

c. Legislation Pertaining to Peatland Development

Peat is classified as a surficial material and peatland development is subject to the conditions for licencing and leasing outlined in the Public Lands Act - Surface Materials Regulations (Alberta Regulation 11/78).

In the absence of specific guidelines for peatland development, developers are issued miscellaneous licences or leases with some modifications specific for peat. Application for both licences and leases must be accompanied by the following information:

- exploration data on the amount of peat availale (including peat depth and quality)
- an operating plan containing information on the method of recovery (harvesting or mining method) to be used, the volume to be recovered, processed and sold, drainage schemes, plant size and number of employees, transportation facilities, source of power and proposed annual production rate
- a development and reclamation plan prior to development

There are no specific reclamation guidelines for peatlands but modifications to existing guidelines for large scale projects could be used. The regulations simply indicate that "An operator shall reclaim the surface of the land ... a) as operations progress, or b) at completion of operations in accordance with the request of the Minister" (Section 18(1)). Following sections (18(2), (3), (4) and (5)) indicate that if the reclamation is carried out satisfactorily, the security deposit which is required prior to the land being leased will be refunded. If reclamation is not satisfactory or not carried out, the security deposit is not refunded. However, according to the Schedule of Fees, Rentals, Royalties, Security Deposits and Surcharges, peat leases are exempt from the general $250/acre security charge. On a peat area of 100 ha (220 acres) this would be a very restrictive sum. However, no other security charge has been established to help secure reclamation costs. Lease rentals and royalties are also considerably less for peat than for other surficial materials. Lease rentals are $1.00 per acre for peat, compared to $7.00 per acre for other materials; royalties are $0.05 per cubic yard for peat (also gravel, and marl) compared to a range of $0.10 to $0.30 per cubic yard for other materials. A lease term is usually 10 years.

Aside from the general lease requirements, there is no provincial legislation affecting peat for horticultural peat production - the only existing peatland development of any consequence in the province - fuel peat development or agricultural utilization. There is, however, some indication of proposed changes to the current development regulations, by way of deregulation, to simplify the process for small scale operators.

x) British Columbia

a. Overview and b. Major Actors and Initiatives

Peat as a potential energy source has not been identified as being of particular interest or importance in British Columbia. Managing the resource for energy purposes would be the responsibility of the Ministry of Energy, Mines and Petroleum Resources. The ministry is not, however, currently involved in any peat or peat-related programs (this includes the Conservation and Renewable Energy Branch which would be responsible for any energy related activities). Peat has, however, been designated as a resource for inclusion in the minerals sub-agreement of the proposed federal/provincial ERDA program. Thus, if interest should develop in peat mining in the future, it would be eligible for funding under that program.

The Province currently has no plans to carry out a peatland inventory. Some work is underway by the Pacific Research Station, Agriculture Canada, and another study of the peatlands of the Queen Charlotte Islands and the northwest coast has been carried out on contract as part of a larger study for the NEP-Peat Program. However, the provincial government has had no involvement in this work.

The province had one horticultural peat moss producer - Fisons Western, formally Western Peat Moss Co. - which was active until 1984 in Delta, B.C. in the Fraser River Delta Region. The producer's operation was unusual because it was the only wet mining development in the country, and had been in operation since the 1960s. Previously-developed bogs in the same area are now the country's major cranberry producing region. This is, in fact, a reclamation scheme which was introduced a number of years ago by Langley Peat Co. Although these peat moss operations were amongst the earliest in Canada they are isolated occurrances in the province, and the peat industry is not an actively growing industry in British Columbia, nor is it receiving any special attention from provincial ministries.

The area in which peatlands have been receiving most provincial attention has been agricultural development. Studies and projects on the agricultural development of peatlands are the responsibility of the Ministry of Agriculture and Food. The Engineering Branch Service, Soils Branch Service and Kamloops Research Station have been involved in peatland utilization.

In British Columbia, wetlands occur in two distinct regions: the Interior and the Fraser River Delta. The agricultural uses and problems associated with organic soils - or peatlands - are very different for each region. In the Interior, wetland meadows are being developed for forage crop production while in the Delta, peatlands have been used since the first quarter of this century for vegetable production.

1. The Wetland Meadows Development Program

The Wetland Meadows Development Program was introduced to encourage the improvement of organic wetland areas (peatlands) for forage crop production in the Interior. These areas have been used for extensive grazing since the early development of the ranching industry and have been a major source of winter feed, although forage yields on natural wetlands are generally low.

Since the meadows are considered to be the most important forage-producing areas in the interior, the program has, over a number of years, developed drainage, seeding and fertilizing techniques which it recommends be used to increase production yields. The main problem currently encountered is that although these techniques have been used successfully to increase yields, they are costly. The costs of improvement often exceed the value of the rangeland being improved - an obvious barrier to encouraging land improvement. The Wetland Meadows Development Program is an on-going development program, and most of the effort is being directed toward improved drainage techniques.

The Fraser River Delta is one of several important vegetable-producing areas in the country. The organic soils in this region are farmed very intensively, producing two crops per year. These soils have been under production for up to 50 years or more, but the area is now suffering from soil depletion. In some locations the problem is so acute that mineral soil islands are appearing through the remaining, shallow layer of peat. In addition, poor crop management practices and the use of heavy, largely inappropriate machinery has led to soil compaction problems and resulting drainage problems.

The problem is serious because of the extent of the resource. The holdings of many farms consist entirely of organic soils. An obvious solution would be to introduce a crop rotation system, planting forage crops to improve soil structure. Unfortunately this is not economically feasible for the farms in question which rely on full utilization of their land area.

The provincial Ministry does not have a mandate to conduct research. Its role is to act as an extension service, providing advice and expertise to solve problems such as this. However, the Ministry currently has no solution to offer the farmers to solve the debilitating effects of "over-cropping".

Although this is obviously a special problem, there are currently no programs established to solve it. Organic soils do not have any unique resource status in the province, although they form an important resource base for specialty crop use. The problems associated with drainage, soil fertility and cropping come under the regular soil programs.

2. Funding for Improvement Projects

Funding for wetland meadow development has been available under the most recent Agriculture and Rural Development Agreement - a Department of Regional Economic Expansion (DREE) - Ministry of Agriculture Agreement. The Agreement was organized into 4 main divisions:

- Part 1 - Research, Planning, Market Promotion and Training
- Part 2 - Coordinated Resource Management
- Part 3 - Primary Resource Development
- Part 4 - Support Services and Community Development

Parts 2 and 3 were of particular relevance to agricultural development of peatlands.

The objectives of Part 2 were to

a) develop and improve the grazing capacity of the Crown Range to utilize the forage production of this resource

b) optimize multi-use possibilities, thereby supporting and stabilizing the beef industry in harmony with forestry, recreation and wildlife interests

The Program was intended to involve the resource user, land owner and government agencies. The program provided 90% of the funding and 10% came fom local users. Improvements eligible under the program included, among others, water management, seeding and weed control.

The objectives of Part 3 were:

a) improvements to drainage works to provide drainage outlet

b) development of community irrigation systems for both horticulture and forage crops production to bring water to the "farm gate"

The Program is directed toward upgrading land capable of intensive agricultural production. Seventy-five percent of the project costs were covered by the Government agencies, while 25 percent came from the applicant. This program ran from 1977 to 1982. A new agreement still has not replaced this one. Limited funding is available under the Agricultural Land Development Act (ALDA).

c. Legislation Affecting Peatland Development

In British Columbia, peat comes under the jurisdiction of three Ministries:

- Ministry of Lands, Parks and Housing
- Ministry of Energy, Mines and Petroleum Resources
- Ministry of Agriculture and Food.

The Ministry of Lands, Parks and Housing administers the Land Act, which includes peat (section 15) as material that can be removed from Crown land upon obtaining a licence or a lease. There are no specific policy guidelines for peat extraction, general policy guidelines would be applied in the case of a licence or lease application.

Where peatlands - or organic soils - show agricultural potential (depending on their extent, fertility and depth), they are incorporated into an Agricultural Land Reserve and may be used solely for agricultural purposes. In this regard, peat is considered to be a soil and therefore subject to the regulations of the Soil Conservation Act, administered by the Ministry of Agriculture and Food. The regulations require that anyone removing soil or placing fill on land situated within an agricultural land reserve must obtain a permit to do so from a local authority. There are no guidelines concerning the mining or extracting of peat from such areas. Since any peat areas which would be suitable for extractive purposes have much the same characteristics and occur in the same areas as those suited for agriculture, the above policy would generally preclude any development other than for agriculture.

IV THE PRIVATE SECTOR

A. Introduction

Four groups undertake peat-related activities in the private sector: private industry, universities, consultants and environmental/ conservation groups. This chapter describes the extent and state of the only commercial peat-related industry in Canada - the horticultural peat industry. The peat and peatland-related research areas of Canadian universities and consultants are also described in this chapter. Finally, the efforts of environmental/conservation groups related to peatland preservation are discussed.

B. Activities

i) Private Industry

The Horticultural Peat Moss Industry

The Canadian peat industry is based almost solely on the production of horticultural peat moss. Although it is a small industry with a low national profile, it has significant regional importance, particularly in eastern Québec and Northeastern New Brunswick where peat moss mining is concentrated. The industry has been developing independently over the past 40 years and has traditionally been composed of small, family-owned operations. In recent years, this has been changing as production becomes dominated by a small number of large producers.

Peat moss is most commonly used as a soil ameliorator, providing the organic matter which improves soil structure and thus the water-holding capacity and aeration properties of the soil. It is also used as a growing medium for seedlings, primarily in greenhouses. In Canada, as elsewhere in the world, horticultural peat moss is mined using dry-mining methods (primarily milled peat production) and is dependent on favourable natural drying (air and solar) conditions. The peat moss is dried to approximately 50 percent moisture content (although this varies widely from producer to producer) and is compressed and sold as 4 or 6 cubic-foot plastic-wrapped "bales". There are very few specialty products on the market, although the larger producers are developing and marketing special peat mixes with nutrient additives and soil mixes. Commercial greenhouses and home gardeners (i.e. retail sales) are the two most important peat moss user groups.

Canadian peat moss producers export approximately 90 percent of their product to foreign consumers, predominantly to the United States. "Off-shore" markets such as those in central Europe, Japan and the middle east are poorly-developed but are seen as potential markets for the future.

Sixty percent of the country's peat moss production is concentrated in eastern Canada, essentially in southeastern Quebec (35 percent) and northeastern New Brunswick (25 percent). Production is dominated by a small number of large producers such as Les Tourbières Premier Ltée. (Premier Peat Moss) and Lambert Peat Moss in Quebec; Fafard Peat Moss Co. Ltd. in Quebec and New Brunswick, and Fisons Western Corporation in New Brunswick. There is only very minor activity in Nova Scotia and Prince Edward Island, and peat moss is currently not being produced commercially in Newfoundland. Eastern Canadian peat moss production is exported primarily to the eastern seaboard of the United States.

Quebec, with approximately 40 companies, (the largest organization, Premier Peat Moss, is itself composed of six or seven smaller subsidiary producers) has the largest annual production - approximately 5 million 6-cubic-foot bales per year, representing 35 percent of Canadian production. The three largest producers - Premier, Lambert and Fafard - account for 80% of the total annual production.

New Brunswick has 17 commercial producers, which together hold the developing rights for 12,315 hectares (1,826 in private ownership and 10,480 hectares as leases) of which 2,328 ha are in production. Of these 17 producers, 12 are actively mining peat moss. The remaining companies have only recently acquired the leases for their holdings. New Brunswick producers mine and pack approximately 3.5 million 6-cubic foot bales annually. This production accounts for 25 percent of the total Canadian production and over 60 percent of this is achieved by the two largest producers - Fisons Western and Fafard. Medium-sized producers, such as ASB Canada Ltd., Heveco Ltd. or Acadian Peat Moss Ltd. in the east produce approximately 350,000 bales per year. Smaller producers range between 50,000-200,000 bales per production season.

Although Ontario has vast peat resources, it does not have a peat moss industry. There is one small commercial producer operating in the Niagara region and total production is exported to the United States. Ontario imports peat moss from Québec and New Brunswick.

Western Canadian commercial production is not as intensive as in the east and there are far fewer producers involved. Production in this region is dominated by the British subsidiary Fisons-Western Corporation which, in addition to its New Brunswick unit, has harvesting operations in central Alberta and southeastern Manitoba producing 1.5 and 2.0 million bales per year. There are three smaller producers also operating in central Alberta with a continued production of 200,000 bales per year. In Saskatchewan, peat moss harvesting is carried out by the provincially-owned Carrot River Peat Moss company. As of summer, 1984, Fisons Western (formally Western Peat Moss Co.) ceased its harvesting operations at the Delta Bog site on the southwest coast of British Columbia. This was the only commercial peat moss producer operating in British Columbia. The largest market for western production is in California. Manitoba also exports its product to a large market in the central United States and the midwest.

In both eastern and western Canada the Canadian peat moss industry has been experiencing difficulties. In eastern Canada, the problem is due primarily to over-production and the fierce competition amongst the numerous producers. There is very little product diversity and, because of the over-production of peat moss, producers are now looking for new product ideas and new markets. Currently, there is only one company in Canada - Jiffy Products Ltd. - which may be classified as a secondary manufacturer using peat moss as a raw material for its product. Both the Quebec and New Brunswick governments have commissioned studies investigating technical applications and market opportunities for new or "re-invented" products from peat. The New Brunswick government is actively discouraging any new peat moss production, while trying to encourage the growth of a secondary industry. The Québec government has not yet taken similar measures.

In both Québec and New Brunswick, several alternative products have been identified as being possible for development, including: peat coke; activated charcoal from peat; peat as an energy source for use in cement kilns and industrial boilers; and peat for oil absorption. These products are not new and have been tried in Europe in the past but have met with little success. There is also a lack of a clearly-identified market for these new products although potential markets do exist.

To produce, test and market new peat products requires money and expertise. While the larger producers have this capacity, the small and medium scale producers do not have the resources to carry out the development work; thus these producers rely heavily on the provincial government involvement in this role. Both Québec and New Brunswick have commissioned research into product development. This is being carried out by private researchers such as the Peat Research Centre at the University of Moncton, the Shippegan Campus in Shippegan, New Brunswick and the Department of Engineering, University of Sherbrooke, Quebec. Peat coke appears to be attracting the most research attention at the moment. Large producers such as Premier Peat Moss Ltd. and Fisons-Western Corp. are involved in their own R&D interests.

In western Canada, primarily in Alberta, instability of the industry in the 1970s meant that peat moss exports to the western United States became unreliable. Accordingly, the American market switched to substitute products such as shredded bark, straw and other fibrous material. These products were less expensive and supply was reliable. Now that the industry is stabilizing in the west (although the number of individual producers is very small), it must try to reattract its old market - both for horticultural peat moss and special mixes, and for new or rejuvenated markets which would use peat moss for purposes other than horticultural applications.

Suggestions have been made concerning the new marketing of an old product, with a number of specific markets in mind. These include the retail or home garden market; commercial growers; landscapers; reforestation operations - including government nurseries and lumber companies; the mushroom industry and livestock bedding suppliers.[20]

Although there is a need to rejuvenate the industry through product development and more imaginative marketing, a more immediate, on-going problem requires attention in both the east and the west - the high cost of product distribution. Peat moss is a very expensive commodity to transport due to its very high volume-to-weight ratio. The situation is aggravated by the fact that markets are at very great distances from the production areas.

In order to distribute the product at as low a cost as possible, small producers in eastern Canada have traditionally sold their product to brokers. The brokers - located primarily in Ontario and along the eastern seaboard - agree to buy the total production from a number of producers, at a price fixed early in the season. The peat moss (of varying grades and quality) is sold under one or several brand names. At a time of over-production, the producer must sell at whichever price might be set by the broker. The producers are heavily dependent on this system for the distribution of their product and have little control over it themselves. The large-volume producers can handle their own product distribution and some have also acted as brokers for the smaller producers in their region. However, they are also faced with the challenge of overcoming high transportation costs.

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[20] Mr. Jack Bell - Vancouver, British Columbia, personal communications. Former President: Langley Peat Co.

The Alberta producers have a convenient system which helps to reduce their freight costs. Their product is sold to the California market. Since the producers are located near a large urban centre (Edmonton) which imports produce from California, they can ship their product to California as back-haul freight. The eastern producers do not have this advantage.

The producers in Canada's peat industry are suffering from common, shared problems: over production, the need for alternative products, improved marketing and improvements to the system and costs of product distribution. Producers Associations can provide a forum in which these problems might be discussed and solutions found. Although such associations have existed in the past, they have not been successful. Possible reasons for this include:

- the peat producers themselves, particularly the family-owned operators, are remarkably individual and do not appear to feel comfortable dealing with larger organizations or with their competitors

- competition among small producers to sell essentially identical products is fierce and large producers can effectively dominate an association even though the majority of the membership may be made up of small producers.

As the industry's problems have become more acute, associations have began to re-emerge. Alberta's four producers are now in the process of re-instituting their Alberta Peat Moss Harvesters Association. The association, if successful, will look primarily at the common problems associated with marketing and reducing the costs associated with artificial drying (Alberta producers, unlike eastern producers, use gas-fired dryers to dry their peat moss).

The government of New Brunswick, with financial assistance through the Regional Development Agreements, is sponsoring a resurrected New Brunswick Peat Producers Association. For the first year, the government will support a full-time, salaried manager. Marketing and centralized distribution will be the main concerns of this association. There is also a Peat Brokers

Association made up of the larger firms such as Premier, Fafard, Fisons Western and Annapolis Valley. The association is concerned only with the eastern market. Québec producers do not have a currently active association.

Although the associations may be able to deal with problems of marketing and distribution, the challenge of product development and quality-control present special problems. Small producers do not have the facilities, expertise or capital to carry out either research and development or measurements of basic quality parameters. The larger producers have the capacity to approach this independently. Fisons-Western, in particular, has the advantage of the support of its research facilities and experience in England. The company has also recently decided to develop its own Canadian research facilities at one of its (yet to be selected) production units. The Fisons-Western group appear to be concentrating their efforts on developing new products for the horticultural industry rather than becoming involved in radically different products. They will undoubtedly be pursuing this goal completely independently of their competitors. By working with commercial users, they will be developing products for specific and specialized applications and will possibly look to other specialty markets for horticultural peat moss.

As the larger producers become more involved in their own product research and development, the industry will become more sophisticated. The directions taken by Fisons-Western are certainly bringing the expertise and attitude from a highly sophisticated European industry to Canada. The German experience is also having an effect on the Canadian peat moss industry through such firms as the German subsidiary, ASB Canada Ltd. and Heveco Ltd., both established in New Brunswick.

The problems faced by the peat moss industry in Canada might also be viewed from the point of view of the product users. The demands placed by European peat-moss users, particularly the commercial growers, on their producers are far more stringent than those which Canadian producers must satisfy. The difference is even more exaggerated when comparing the attitudes and expectations of the very knowledgeable Europeans to the more casual and uninformed North American home gardeners. The problem may partially lie in the lack of demand for peat moss of assured or constant quality or in the equally low demand for peat moss products developed and intended for special applications.

There are very few companies in Canada outside of the peat moss industry which specialize solely in peat or which can afford to be dependent on peat as their primary source of contracts. A newly-formed Newfoundland company, High Point Peat (owned jointly by NOVAL Enterprises and Terra Nova Power and Development Corporation) has taken over the operation of the High Point Bog, developed during one of the CREDA fuel-peat demonstration projects. The company plans to harvest the horticultural grade peat to produce a product called OCLANSORB which is an oil absorbent. The product will be marketed for use at home or for industrial spills, such as in commercial garages. The success of this venture is yet to be determined.

Most small peat moss producers have preferred to design, build and maintain their own equipment. The equipment frequently consists of modified farm machinery but a few special designs (such as the drum for the vaccum harvester) have been built. Equipment maintenance is carried out in winter when harvesting operations cease. As a result, there are only two peat-harvesting equipment manufacturers in the country - Tardiff et Frère in Riviere du Loop and Hakumet in Dorion Quebec. Although there is a small Canadian market, both firms must look outside Canada to sell their product.

ii) Universities

A wide variety of disciplines are involved in peat-related research, including researchers from departments of Biology, Geography, Forestry, Agriculture, Engineering and Chemistry plus multidisciplinary programs such as Environmental Studies, Resource Management and Planning.

University research is concerned with the academic interests associated with the botanical structure of peatlands, peatland geochemistry and the process of peatland development as well as the practical aspects of developing and managing peatlands and peat product development. For example, actual projects which are concerned directly with peat can vary from the development of farm equipment for use in vegetable production on peatlands (Memorial University) to the use of peatlands for wild rice production in Manitoba (University of Manitoba), and from extracting organic chemicals from peat pressate (University of Sherbrooke) to studying the role of peatland geochemistry in the development of peatland types (University of Alberta and McGill University).

Funding for current work comes mainly from two sources: the National Science and Engineering Research Council (NSERC) and the NEP-Peat Program. NSERC is the traditional source of funding for university-based research in the physical, biological and engineering sciences. Five peat and peat-related projects are currently being funded . The NEP Peat Program is also providing funding for studies which supplement the government's own activities in the various Peat Program sub-programs. This research has a more practical orientation than NSERC-funded projects, which are generally more academic in nature. Some funding also comes via provincial government departments. New Brunswick, for example, has sponsored research on product development which is being carried out by university researchers.

Several areas of current university research activity may be identified. Basic research includes investigations of:

- ecosystem analysis (i.e. geochemical studies, vegetation structure, peatland morphology and development)
- palynology and paleoecology

- hydrology
- peat chemistry

More recently, researchers have become involved in investigating practical issues and implications arising from peatland development. This research has included such areas as:

- environmental impact assessment
- peatland forestry
- reclamation of developed peatlands
- peat processing and product development
- thermal properties of peat

These practical research initiatives have been funded primarily through the Peat Program. With the exception of peatland forestry, all of the above areas have been encouraged through the recent emphasis being placed on the potential for energy development. University researchers have also been aligning themselves more closely with the industrial sector as another potential source of funding or by offering back-up expertise. Applied research therefore often has an association with industry which brings the results closer to practical applications, whereas the academic interests generally remain within the university setting.

A number of strong centres of peat research expertise have developed on a regional basis: Memorial University in Newfoundland; University of Moncton - Shippegan Campus in New Brunswick; University of Sherbrooke and McGill University in Québec, and the University of Alberta.

Undoubtedly there are researchers in numerous other universities involved in peat and peat-related projects. The following centres are included for illustration purposes only because their current activities in peat place emphasis on studies of regional significance.

a. Memorial University, Newfoundland

Researchers at Memorial University in St. John's Newfoundland are exceptionally well located to carry out research, both pure and applied, on a variety of topics concerning peat and peatlands in the province.

In 1977, a symposium on the Peatlands of Newfoundland and Labrador was sponsored by the University. This led to the formation of the Newfoundland-Labrador Peat Association (appendix 6).

The Department of Engineering and Applied Science has been heavily involved in peat-related projects. It has been particularly active in the two CREDA-sponsored fuel peat demonstration projects. Management of the Bishops Falls project was under the partial control of the University from July 1980 until project completion in December 1982 through its involvement as a joint venture partner. The university was responsible for designing the drainage pattern used in the St. Shotts demonstration project. In both projects, the University worked in close cooperation with federal and provincial government agencies and private industry. The Department of Engineering and Applied Science has also worked cooperatively with the federal Department of Agriculture to develop machinery (e.g. cultivation and harvesting equipment) for use in vegetable crop production on peatlands in the province.

b. University of Moncton, Shippegan Campus

The Peat Research Centre at Shippegan in northeastern New Brunswick has been in operation since March, 1983 when it received a two-year operating grant through the New Brunswick Community Improvement Corporation and the (then) federal Department of Regional Economic Expansion (DREE). The Centre is located in one of the two major horticultural peat-producing regions in the country. Following the September 1982 Peat Symposium held in the region, it became apparent that a research and laboratory service would be valuable to the local horticultural peat producers. This led to the proposal to establish such a centre at the Shippegan Campus of the University of Moncton. The Centre has two full-time staff members (a coordinator and one technician) and, in addition to its research activities and laboratory services, will also incorporate teaching, particularly at the graduate level, as part of its activities. The Centre is ideally located to train researchers in basic and applied peat and peat-related research.

The Centre intends to concentrate its efforts on at least seven areas of particular interest:

- research into improved methods of transportation, aimed particularly at reducing the cost of distributing horticultural peat moss
- research into new products in the horticultural industry as well as other potential industries
- research into new harvesting and packaging methods
- product quality control
- marketing, including improved packaging and labelling
- peatland reclamation following harvesting
- developing a reference library on all matters related to peat

Research will lean heavily toward solving the practical problems arising in the horticultural peat industry.

Funding for these projects will come from both federal and provincial sources. All research related to improved mining methods, product distribution, development and marketing will be carried out on contract with the provincial government. Funding will be channelled via the Regional Development Agreement - Northeast Subsidiary Agreement.

Research into peatland reclamation is being carried out in association with the Peat Program reclamation studies being coordinated by the Land Resource Research Institute - Agriculture Canada.

The Centre wishes to develop strong contacts with the local producers in the region. The most direct means of achieving this is to offer a consulting service to the producers, making the laboratory facilities available for analysis of such basic peat properties as pH; fibre content; organic matter content; water content and nutrient content. Such a service would provide small producers with their first opportunity of having better control over the quality of their product.

Research into product and market-related problems is also being carried out with the intent of finding solutions to the difficulties which the New Brunswick producers are currently experiencing. The services of the Centre will be particularly valuable to the small and medium-sized producers who do not have the capacity or capability to carry out such investigations but who are in competition with larger producers with more sophisticated facilities. Thus, the peat and peat-related research activities of this university group have a very real regional and practical importance.

The Centre is now negotiating for funding for another five years, which would allow it to carry out longer-term research. The Centre does not see a need for becoming involved in fuel peat; it intends to concern itself with improving horticultural products and has also expressed an interest in developing alternative products such as peat coke.

c. Sherbrooke University, Quebec

Members of the Department of Chemical Engineering at Sherbrooke University have been involved with peat research since 1971 when they first received a $1.5 million three-year NSERC grant to carry out peat carbonization studies. The researchers originally involved in these studies have subsequently divided into two groups.

The first group of researchers might more accurately be identified with private industry than with the university itself - their association being with the Lavalin subsidiary group of André Marson and Associates Inc. Through their original NSERC-funded research and subsequent projects in association with private industry (funded through a variety of sources - including federal and provincial government projects) they have been involved in such areas as developing carbon products from peat - including coke, activated charcoal, etc; investigating the absorbitive properties of peat and improving and developing new peat products for use in the horticultural industry.

The second peat research direction in the Department, carried out independently of the André Marson group, is concerned with the peat dewatering process and fractionation of peat solvents. Specific attention is being given to two interrelated topics:

- developing a dewatering process which would produce a "carbohydrate-poor" peat solid and a "carbohydrate-rich" waste liquid and
- retrieving those carbohydrates expelled from the peat during the thermal-mechanical dewatering process

Part of this research is being funded throuth the Peat Program and is being carried out in connection with the dewatering and processing sub-program. Funding is also coming from NSERC.

d. McGill University, Québec

The Department of Geography at McGill University has had an on-going interest in peat-related research for many years. Its concerns have been directed almost exclusively to peatlands in sub-arctic enviroments, and a considerable amount of work has been carried out by this department at the McGill Subarctic Research Station in Shefferville, Quebec.

Until recently, the Department of National Defence was the sole sponsoring agency and the peat-related research was one part of a broader research project involving various aspects of terrain analysis. Remote sensing and terrain mobility in northern environments have been two areas of concentration. Very recently, peatland geochemistry has become a topic of research interest in the same department. The work is being funded through an NSERC grant and will look at geochemical aspects of peatland development in sub-arctic ecosystems. The study is being funded for a three year period.

The same department has also been involved in the peat water sampling program established as part of the environment sub-program operated by EPS for the Peat Program.

e. University of Alberta, Alberta

Peatland research in the Department of Botany has focused on peatland formation based on the principles of peatland geochemistry. The study, which is being funded for the next three years with an NSERC grant, will be concerned with measuring and categorizing peatland development using vegetation and chemistry as well as production and decomposition. The intent will be to determine why peatlands develop from minerotrophic to ombrotrophic systems. Investigations will be concerned at first with the development of peatlands in central Alberta, but it is hoped that the acquired information may be used in regional comparisons to help establish patterns of peatland development. Comparision of the results of these studies with those from Northern Quebec is seen as a potential beginning for obtaining regional patterns of development based on differences in peatland geochemistry. This is one aspect of peat research which is not being approached through the government research program involved in peatland classification studies.

Other potential areas of related research could include the acidification process in peatlands; development of peatlands on a continental basis; seasonal dynamics of nutrient flows in peatlands; and the vertical distribution of nutrients.

During the academic year 1983-84, the Department of Botany and the Department of Soil Science jointly offered their first course devoted to peat and peatlands. The objective of the course, entitled 'Peatlands', is to consider peatland ecosystems in terms of their formation, biotic and abiotic components, stratigraphy, evolution, classification, conservation and utilization. The course, which is composed of lectures and field and laboratory sessions, has drawn participants from a number of university departments as well as from government agencies.

The Departments of Forestry, Geology and Engineering are also involved in peatland research. The University has established a four-phase forest drainage study which began in July 1981 and will continue until December 1985.

iii) Consultants

The recent increased government interest and activity in peat research and development has fostered the expansion of private industry expertise in this field. Consulting firms - primarily survey, resource and environmental management and engineering consultants and including policy consultants - have become active in virtually every aspect of peat R&D and resource development. Their involvement has included peatland inventories and resource assessment; peat harvesting and site design and preparation; equipment manufacturing; processing research; product development; environmental impact assessment and policy research.

The federal and provincial governments are virtually the sole source of contracts and the recent, rapid growth in this "service sector" has been in direct response to the research requirements of the NEP-Peat Program. (A considerable amount of work under this program is carried out on contract by private industry.) Prior to the Peat Program, there was very little opportunity or necessity for the private sector to become involved in peat. By contrast, the horticultural peat moss industry itself has not been a factor in encouraging the growth of the service sector.

Resource management and aerial survey consultants, specializing in resource inventories, have been involved since the mid-to-late 1970s (a period when the provincial governments began developing their peat resource inventory programs). The Ontario survey program, now in its third year, has had the most extensive involvement from private contractors. The Newfoundland survey was also carried out on contract, but has involved only one resource consulting firm. Other provinces with completed or on-going programs, (e.g. New Brunswick, Nova Scotia and Quebec) have conducted their inventories with in-house personnel. If Alberta approves initiation of a peatland inventory, the work will most likely be awarded to the private sector.

The CREDA fuel-peat demonstration projects opened new areas of involvement to the private industry. Resource assessment, site planning and preparation and harvesting have been carried out by engineering and resource development consultants. However, because of the lack of local expertise in this energy sector, much of the knowledge was acquired as the projects progressed. Any future projects will benefit from this "apprenticeship" period. Private industry has also become involved in the R&D activities, in processing research (particularly dewatering technology), technology assessment studies and environmental investigations.

The demonstration projects have not yet been followed by commercial activity, nor is the commercial development of the fuel industry being encouraged at the moment. Therefore, contractors who developed some expertise in the fuel-peat sector are currently finding themselves without a market for their newly-acquired skills. Since the Peat Program is concerned with research and development, commercial activity cannot be expected to evolve immediately from this program.

Resource and engineering consultants who specialize solely in peat are rare. Technopeat, a subsidiary of Hakumet and of the Finnish company Turverruki Oy, is the only consulting group in Canada which concentrates its services entirely in the peat development sector. Monenco has slowly built up a core of expertise in assessing and developing peat technology - primarily in the fuel-peat sector - since its first series of peat-related contracts with the Department of Energy, Mines and Resources in the 1970s. The company has recently organized its small group of experts into a Peat Group. This group is concerned entirely with acquiring and carrying out peat-related projects. The group can also draw on engineering expertise in related fields from within the company. The Ontario Research Foundation also has a small group of researchers which is now concentrating its efforts in peat-related research. The group's work has been concerned primarily with thermal pre-treatment technologies - particularly the wet-oxidation method - which has grown from their expertise in the wet oxidation of biological wastes. The application of the wet oxidation process to peat slurries developed from an unsolicited proposal submission which was eventually funded by the National Research Council. This work has become an important aspect of the peat-dewatering and processing sub-program. The research is also involving them in the technological side of the environment issue - such as characterizing and treating the by-products arising from peat processing. Whereas Monenco and

Technopeat have placed greater emphasis on the practical aspects of peat development, including feasibility and evaluation studies, site design and preparation, the Ontario Research Foundation concentrates heavily on Research and Development. Project interests frequently overlap and there is a large degree of sub-contracting which is carried out between these firms.

Given the very small Canadian market and the very limited sources of funding for these services, private industry must look toward international markets - this has become synonomous with markets in developing countries. International competition is formidable - particularly with the involvement of Finnish, German and Dutch companies and agencies. Recent interest in developing peat resources in Senegal has meant a few consulting contracts for Canadian researchers and developers. Contracts have been awarded through the Canada International Development Agency (CIDA), the International Research and Development Corporation (IRDC) and directly via the Senegalese government.

iv) Environmental/Conservation Groups

In Canada there are conservation groups at the local, provincial, federal and international levels which are dedicated to preserving wildlife and their habitats. Peatland preservation is acknowledged by most of these groups as being part of their general goal of nature conservation. However, it is not at the present time generally considered to be a particularly significant issue. Preservation of peatlands is perceived as a part of the issue of wetland preservation and has therefore occurred mainly as a coincidental consequence of the protection of wetlands in general.

Most conservation groups solicit funds from private and corporate sources. They also accept land donations. Some groups actively purchase land to ensure its conservation. The main purpose of other groups is to educate the public, lobby the federal or provincial governments to preserve areas for wildlife, and/or provide a means for members to share their appreciation of nature.

Ducks Unlimited Canada (D.U.C.) is a non-profit organization committed to preserving and creating waterfowl habitat in Canada.[21] D.U.C. pursues a policy of direct intervention in the marketplace by purchasing areas of land which are managed to increase the productivity of, or to create, wetland communities. With regard to peatlands, this might be a questionable approach to conservation. For the purpose of waterfowl management, peatlands are not considered to be as productive as earlier successional stages such as marshes and swamp. In order to improve the productivity of peatlands for this purpose, the areas must be subjected to controlled flooding - thus enhancing the peatland as a waterfowl breeding ground and expanding the waterfowl habitat of wetlands. If the objective is conservation of wetlands, this practice might be viewed as valid. If, however, the objective is conservation of the natural wetland environment (including peatlands in their normal state) - this might merely be considered one form of exploitation.

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21 letter received from Patrick Caldwell 27 July 1984

The Nature Conservancy of Canada (N.C.C.) is a non-profit organization dedicated to the preservation of ecologically-significant natural areas, unique natural features, and places of special beauty. The N.C.C. purchases areas of land in order to ensure their preservation in a natural state. The Conservancy does not hold property acquisitions indefinitely but transfers them to other conservation organizations or government agencies for management and protection. Wetlands, shoreline properties and areas which provide habitat for a wide diversity of flora and fauna, especialy rare and endangered species, are the priorities of the N.C.C. The Conservancy includes peatland preservation under the general aegis of wetland preservation and "can be considered a mechanism that can be used to assist in peatland preservation."[22]

The Canadian Nature Federation and the Canadian Wildlife Federation both attempt to educate the Canadian public about the value of wildlife and the need for its protection.

The Canadian Nature Federation is a non-profit organization dedicated to "the education of the Canadian public about the value of wildlife and other natural resources and hence the need to protect wildlife and habitats through promotion of protective legislation."[23] The organization carries out lobbying activities - (i.e. prepares briefs for hearings and presentation to individual politicians), and manages and provides interpretation of areas of land it has purchased or received through donations. It also produces the magazine Nature Canada, which fosters awareness and appreciation of nature.

The Canadian Wildlife Federation (CWF) is dedicated to "fostering understanding of natural processes so people may live in harmony with the land."[24] The organization pursues a flexible policy of action unique to each issue. These actions include: lobbying, direct intervention (purchasing areas of land), research and investigation. C.W.F.'s involvement in peatland preservation to date has consisted of assisting in the attempt to prevent the rezoning of the Alfred Bog, eastern Ontario to allow development to occur.

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[22] letter received from Kellea Cole 26 July 1984.

[23] B. Pratt, ed., Canadian Conservation Directory (Ottawa: Canadian Nature Federation, 1979), p. 9.

[24] Ibid., p. 10.

Unlike the organizations discussed above, Canada Wildlife Habitat was established in February 1984 as an independent foundation to protect wildlife (including plants) in Canada through the purchase of land areas. It received a $1 million grant from the federal government and a $2 million loan. The Sportsman Fund of Canada will contribute money on a yearly basis. The board of the Foundation will be composed of two provincial appointments, three Department of the Environment appointments, two representatives from conflicting uses (i.e. forestry or mining), two representatives from conservation organizations (Nature Conservancy of Canada and Ducks Unlimited Canada). In addition, Dr. David Suzuki and the Canadian Wildlife Artist, Robert Bateman, will sit on the board. Wetlands (including peatlands) will be given some priority - mainly in the Prairies and southern Ontario.

Conservation groups also exist at the provincial level. The group most widely recognized as committed to wetland (inclusive of peatland) preservation is the Federation of Ontario Naturalists (F.O.N.). The F.O.N.'s purpose is to "exert influence to protect our natural environment and promote, through education, an understanding of the needs and values of preserving our natural resource."[25] The F.O.N. has been successful - through lobbying, sponsoring conferences, and educating the public - in persuading the Ontario government to propose a wetland policy.

At the local level, Field Naturalist clubs are present in many communities in most of the provinces. Generally, the purpose of these clubs is to know, appreciate and conserve nature. They sponsor lectures, nature walks and may undertake some lobbying work. One such group, the Ottawa Field Naturalists has recently attempted to purchase a peatland (Alfred Bog).

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[25] *Ibid.*, p. 34.

V INTERNATIONAL EXPERIENCE

A. Introduction

This Chapter presents information on the extent, nature and organization of peat-related programs and activities of several countries which have been actively involved in peat Research and Development. Included are Scotland, England, Ireland, Finland, Sweden, the Federal Republic of Germany, the Netherlands and the States of Minnesota, Maine and Alaska (North Carolina and Florida are also briefly referred to). The emphases on peat Research and Development, the nature of peatland utilization and the government programs and policies addressing the use of peatlands are extremely varied in these countries, as is the degree to which these activities are coordinated.

B. Activities

The United Kingdom

There are no established programs or policies in the United Kingdom for the specific study, development or use of the country's peat resources, nor is there specific mention or attention drawn to peat in other policy areas or resource development programs where peat might be included (such as national energy policies, and development policies, etc.). However, in spite of the lack of formal policy directives, there are a number of organizations (private and public) actively involved in peat R&D and resource management and a number of mechanisms are in place which are being used to bring undeveloped peatlands under protection.

In the United Kingdom, interests and activities of relevance to peat can be broadly divided between those concerned chiefly with conservation/preservation and restoration, i.e. environmental concerns, and those directed toward development - primarily horticultural and fuel-peat development and afforestation of peatlands. The two countries of the United Kingdom most involved with peat-related activities are England, where conservation has become the main issue, and Scotland where development is of greatest concern.

i) England

The traditional use of peatlands in England has been for agriculture. For centuries large areas of peatlands - or mires - have been drained and placed under cultivation. Through this process, natural peatland environments have been dramatically depleted in England. Recently, the situation has been further aggravated by peat extraction, primarily through the activities of the horticultural peat-moss industry which is dominated in England by Fisons Corporation.

The situation of peatlands in Britain was recently described at the 1984 International Peat Congress in Dublin:

> The mires of the British Isles are a diminishing natural resource declining in area and quality as a result of drainage, grazing, afforestation and commercial exploitation. The best examples of those that remain have been designated National or Local Reserves, or Sites of Special Scientific Interest. Although this affords a certain degree of protection, mires are now islands in an increasing urban or rural landscape. Consequently they are exposed to pressures which did not exist during their formation. Very often mires become depositories for Man's waste products or areas where vandalism and destruction are acceptable practices. Even nature reserves are not exempt from the insidious effects of Man's thoughtlessness.
>
> Studies carried out over many years at Chartley . . .and Wybunbury Mosses in the West Midlands of England, both of which are National Reserves of International importance (sic), show that the surface vegetation, peat structure and water chemistry are changing as a result of enhanced eutrophication in a direction that could eventually invalidate their nature reserve and conservation status.[26]

This description is not indicative of the situation in Scotland but is an accurate picture of the problem in England. As a result, conservation and preservation are growing issues for those involved in peat studies in England. As the English countryside is rapidly being absorbed into farmland, the public is taking a greater interest in the conservation process. However, peatlands are not regarded as attractive wildlife areas which should be preserved at any great cost. Farmers prefer to see them drained and used for agriculture and this is actually encouraged by an agricultural grant and subsidy scheme. Town dwellers prefer to see wetlands converted to lakes. As a result, there is not as yet a strong lobby for preservation.

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[26] Rieley, J.O., Page, S.E. and Shah, A.A., "Eutrophication of Afforested Basin Mires in the Midlands of England" in Proceedings of the 7th International Peat Congress June 18-23, Vol. 1. (Dublin: 1984), pp. 375-387.

Legal Controls Over Mineral Extraction

Peat is defined in planning law in England as a mineral and is, therefore, subject to legislation affecting mineral workings. In 1981 a new Minerals Act was passed insisting on restoration of land worked for minerals:

> 30A (1) Where planning permission for development consisting of the winning and working of minerals is granted subject to a restoration condition, it may be granted subject also to any such after care condition as the mineral planning authority think fit.
>
> "after care condition" means a condition requiring that such steps shall be taken as may be necessary to bring land to the required standard for whichever of the following uses is specified in the condition, namely -
>
> (a) use for agriculture
>
> (b) use for forestry or
>
> (c) use for amenity.

This Act gave the County Planning Authority (the authority responsible for administering the Act at a local level) the leverage to insist on restoration. Determining appropriate restoration for peatlands, however, has proven to be difficult.

Agriculture was recognized as an obvious "after use", but since peat is usually dug below the water table, restoration to agriculture would mean the area would have to be pumped continuously. County Planning Authorities soon found that they were not able to insist that landowners pump their lands in perpetuity. The same problem would arise if the area was to be restored to forestry. The only viable after use was, therefore, restoration to a natural ecosystem; but it was not clear how waste areas of despoiled, worked-out peatlands could be made into viable peat ecosystems again.

In the same year that the Minerals Act was adopted, the Wildlife and Countryside Act was also passed. This Act provided the Nature Conservancy Council with a means of conserving natural areas. Any area under threat of development could be considered for designation as an area of Special

Scientific Interest and a stop notice could be put on this land to prevent the landowner from developing the area. Although proving to be a useful tool in preserving natural areas of the English countryside, a conflict with intensive agricultural development is now occurring, which is making the implementation of this process even more urgent in the opinion of conservationists.

England's farmers are pursuing a more intensive system of agriculture by changing from traditional, less-intensive dairy production, to grain and vegetable production. This is in response to two factors. The first is the over-production of dairy products in the European Economic Community and the second is the high cost of good agricultural land (up to $4,000 per acre) which requires high productivity to justify the capital investment. This change to more intensive farming is aided through grants from the Ministry of Agriculture and from the European Economic Community - Common Agricultural Policy.

The grant and subsidy system encourages farmers to turn over meadowland and lowland pasture to arable production. A farmer with lowland meadows can obtain grants to cover most of the drainage costs involved. Over the past 40 years, England has lost nearly 95 percent of its lowland pasture and meadow through this process. The ability of farmers to bring marginal lands into production is resulting in a loss of up to 12,000 acres (4,800 ha) of peatlands and uplands per year.

The Wildlife and Countryside Act (1981) is having some effect, but the cost of implementing the Act is decreasing the effectiveness. A central element of the legislation is to pay farmers not to develop the marginal lands. Some farmers are paid up to $400 per acre ($1,000 per ha) per year to leave their land as meadows or peatlands. However, the cost of applying this Act is so great that many local authorities which are responsible for funding the program cannot afford to do so. At the rate of 12,000 acres (4,800 ha) per year, this would conceivably cost the country $4.8 million for the first year only, without cumulative effects of following years. Increasing public awareness of the value of the "traditional English countryside" and decreasing satisfaction with the current agricultural policies in England and in the EEC is resulting in a shift in influence in this regard from the Ministry of

Agriculture and Food to the Ministry of the Environment. There is apparently growing support behind the idea that Britain needs legislation to adequately protect its countryside.[27]

Preservation and Restoration of Peatlands in England

There are three separate approaches to the preservation of peatlands in England. These affect natural areas of peat, extracted and abandoned peatlands and areas with planning permission for peat extraction.

1. Natural Peatlands

All areas of virgin peat in England have been designated as Areas of Special Scientific Interest or as Nature Conservation Reserves. This means that when the opportunity arises the Nature Conservancy Council will buy any areas under threat of development with the eventual aim of owning all peatlands. Some of these peatlands are actively managed by wardens. The Nature Conservancy Council is confident that these are well managed and controlled.

2. Extracted and Abandoned Peatlands

These areas are becoming the subject of Site of Special Scientific Interest designation and are being controlled in the same way as natural peat areas. Occasionally within the area of designation will be some areas which are being farmed; but as the peatlands are managed more effectively, the fields become wetter and wetter until the Nature Conservancy Council has to buy out the farmer and can manage the site as a natural peatland.

The Nature Conservancy Council pays the market rate for land it wishes to buy. This is assessed by a District Surveyor who is well informed of the current market price of agricultural and peatlands.

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[27] J. Manthorpe, "English countryside rapidly being absorbed into farmland", The Citizen, Ottawa, Canada. August 29, 1984, p. 56.

3. Areas with Planning Permission for Peat Extraction

Until recently, it was unclear how areas worked for peat could be returned to peatlands again. Recent research in Britain and Germany has shown that restoration is possible. It has been found that there are two important layers within a peat bog. The top is an active area of approximately 15-20 cms, overlying an inert base layer which can extend down ten meters. Research indicates that the morphology and hydrology of the top layer is important in determining the development of a peatland. Surface water patterns seem to be the key to peatland development and have led to some new approaches in the restoration of peatlands.

The area to be restored must have a ridge (or baulk) and hollow landscape left by traditional block or hand-cutting harvesting methods, rather than the flat landscape produced by milled peat harvesting methods. A difference of at least 50 cm must remain between hollows and ridges. A planning condition insisting on this can be made part of the planning consent. The baulks are first burned to kill off any woody species growing on them. The drains are blocked up allowing the hollows to flood providing the necessary morphology of surface water to be found on established bogs. It is found that sphagnum will invade the hollow wet areas, moderating the extremely acidic conditions found there, and gradually allowing other species to revegetate the area. In order to ensure that the baulks do not become revegetated with birch, sheep are grazed on the baulks until the bog is reestablished.

A combination of conservation-oriented legislation and research is providing the mechanism through which conservationists in England hope to ensure that peatlands remain a feature of their landscape. However, the continual and increasing pressure from agricultural development suggests that more effective legislation is required to ensure that this conservation trend continues.

ii) Scotland

In Scotland, the emphasis is on peatland development. Peatland afforestation, particularly in the highlands, and small-scale fuel-peat development are the two main peat-related interests.

The Department of Peat & Forest Soils of the Macauly Soil Institute has been responsible for directing peat R&D in Scotland since 1962. Its long-term responsibility has been to evaluate and map the nature and extent of peat resources in the country. This work is on-going and now incorporates the research and development of advanced remote-sensing technology for the purpose of peatland mapping.

With the exception of some grazing areas, Scottish peatlands are, in general, not developed for agriculture. In the past, the peat was completely removed from large areas in order to recover the underlying mineral soil which was then farmed. For this reason, the Institute has not been involved in the agricultural development of peatlands. Recent activities have concentrated on the afforestation of peat soils (in conjunction with the Department of Forestry, Aberdeen University and the Northern Research Station, Forestry Commission) and the use of peat as a fuel source.

Afforestation is the responsibility of the Forestry Commission which is carrying on an extensive program of afforestation in Britain. Much of this work is being conducted by the Commission on behalf of non-traditional land-owners (such as insurance companies) who treat this as a form of long-term investment. Otherwise, the government acquires land from land-owners, usually farmers, by purchasing it on the open market. Peatland afforestation is a new development in Britain. The policy is not specifically or formally focused on peatlands but rather on the afforestation of any available land in Great Britain. Since peatlands are increasingly becoming the only land available for this purpose, they have become of prime concern.

An estimated 60 percent of the annual afforestation (a total of 20,000 to 25,000 ha) is now occurring on peat soils. Much of the activity is being directed toward the blanket bogs of the Scottish Highlands. Afforestation is organized by the Forestry Research Coordinating Committee, which includes members from the Forestry Commission, the Macauly Institute, the Institute of Terrestial Ecology and the Departments of Forestry from several universities. Current research has been directed toward solving soil problems of fertility, wetness and drainage and toward selecting the most suitable tree species for this purpose.

The peat industry in the United Kingdom has been dominated by the production of horticultural peat moss; Fisons Corporation in England and Caledonia Peat Products in Scotland are the major producers. There are a number of smaller producers (approximately 20) the majority of which are located in Scotland. Most are farmers who are becoming increasingly involved in small-scale sod-peat production for fuel purposes. Such sod peat is produced almost exclusively for domestic heating, and the market is local, being restricted to northern rural Scotland. Product demand is low and the market is currently saturated. There appears to be little potential for developing the industrial use of fuel peat on mainland Scotland, although some interest has been shown for the use of local peat resources for energy purposes on the North Hebridine Islands and the Shetland Islands. The industry receives no encouragement or assistance from the government.

The smaller peat producers in the United Kingdom are poorly organized as a group. Although there is a Peat Producer's Association (with its managerial office in Manchester), its membership is sporadic and the association is considered by many producers to be largely ineffective. There is no central agency to handle small producers' problems associated with marketing and product distribution.

The Scottish Peat and Land Development Association (SPALDA) is a society which promotes rural land development in Scotland. SPALDA is now actively promoting peatland development in Scotland and organizes and hosts workshops, seminars and demonstration projects aimed particularly at the small-scale fuel-peat industry. The Association considers peatlands to be a valuable national resource and feels that development of these lands will provide an important source of local employment. Although SPALDA is in a situation to provide a forum for the exchange of information providing technical advice in land development, it has no official status which it can use to influence government policy in this area.

iii) Ireland

Peatland development in Ireland is dominated by the fuel-peat industry and is controlled by Bord na Mona - The Irish Peat Authority. Other development concerns of increasing importance include forestry and agriculture, controlled by the Forestry and Wildlife Service and An Foras Taluntais - The Agricultural Institute, respectively.

The Irish peat industry developed in response to early government policies concerned with job creation, particularly in the Midlands, and with reducing the country's dependence on foreign energy supplies by utilizing indigenous fuels, essentially peat. In 1934, the Turf Development Board was established as a limited liability company charged with the general responsibility of developing the peat resources of the country. It was funded by grants-in-aid from the State and operated under the direction of the Department of Industry & Commerce. In 1946, the Irish Government passed the Turf Development Act which made better provisions for the development in the national interest of the production, distribution and supply of peat in the State. For this purpose it created Bord na Mona - The Irish Peat Development Authority, a semi-state corporation which, in addition to assuming the responsibilities of the Turf Development Board, also had the authority to acquire bogs, to undertake peat research and development, and to promote the sale of peat products. Bord na Mona is chiefly concerned with the production of milled fuel-peat for the generation of electricity in peat-fired generators owned by the Electricity Supply Board. It is also involved in briquette and (some) sod-peat production as well as (to a lesser extent) horticultural peat production. The total area of bog development is approximately 75,000 ha and the Bord now owns 82,000 ha of peatlands.

Bord na Mona operates as an instrument of national policy and, although its duties are set by the legislation of 1946, the Bord has freedom of action to achieve the objectives of these duties. Bord na Mona has its own Board of Directors and staff, and is subject to the Ministerial control of the Department of Energy and Industry. The organization operates on a commercial basis and receives no subsidies or tariff protection. Its main source of capital is the State, in the form of interest-bearing loans. It also receives loans from the European Investment Bank and investment from private business.

The semi-state status of Bord na Mona enabled the organization to become established in a shorter time than would have been possible for a private company. The powers of acquisition granted by the Act of 1946 also enabled Bord na Mona to acquire peatlands at a rate which would have otherwise taken a number of years.

Bord na Mona's production history has occurred in three Development Programmes.[28] The First Development Programme started in 1946. It featured a comprehensive national program for peat development and incorporated the earlier plans of the Turf Development Board. The principal features of the programme were:

- annual production of 1 million tonnes of sod peat, for use in power generating stations, factories, institutions and private houses

- annual production of 20,000 tonnes of briquettes

- annual production of 50,000 bales of peat moss

During this First Development Programme, the Electricity Supply Board (ESB) built a number of peat-fired generating stations. In keeping with national energy policy, the ESB was obligated by Government to give priority to indigenous fuel over imported fuel and thus to purchase the peat supplied by Bord na Mona. There was no direct economic advantage for using peat in power generation - the indigenous fuel priority was based on social and indirect economic advantages.

The Second Development Programme began in 1950. The Programme was characterized by the transition from sod to milled peat production. It also saw the growth of briquette manufacturing. This came as a result of the economic recession in the mid 1950s which forced the ESB to cut back on its plans for increased generating capacity and resulted in Bord na Mona diverting its excess milled peat production to briquette production. Briquettes are intended for use in the domestic or home fuel market. During the Programme, the following annual production was achieved:

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[28] Cooke, J. Peat Production in Ireland (Dublin: Bord na Mona, 1981).

- 900,000 tonnes of sod fuel-peat
- 3.25 million tonnes of milled peat
- 300,000 tonnes of peat briquettes
- 1 million cubic metres of horticultural peat moss

By the end of the second Programme, Bord na Mona had 22 production units in operation and was mining a total of 53,000 ha. The 53,000 ha represented all the available peatland, considered at the time to be suitable for economic large-scale production.

The energy crisis in 1973 led to a further expansion program, the Third Development Programme, which started in 1974. The intent has been to expand production to smaller bogs of 40-60 ha in size. The strategy has been to locate and acquire clusters of smaller sized bogs (which can be administratively grouped together to form larger units) and to move into the transitional bogs located between the West of Ireland and the Midlands. The annual production targets of the Third Development Programme, which incorporate the production levels of the previous two periods, include the following:

- 6 million tonnes of milled peat for electricity generation and briquetting

- 750,000 tonnes of peat briquettes

- 2.8 million cubic metres of peat moss

- 32,000 tons of sod-peat

The three Development Programmes involved the following costs:

- 7 million IRL for the First Development Programme

- 22 million IRL for the Second Development Programme

- in excess of 180 million IRL (estimated planned investment) for the Third Development Programme

By 1982, Bord na Mona had acquired 81,400 ha. Another 6,000 ha have been surveyed for possible development.[29] It is unlikely that the total production area will exceed 90,000 ha.[30] Future development will be directed toward the West of Ireland where unexploited areas of raised bog still exist. These bogs are generally small in size (20-160 ha) and scattered, but numerous. Production on blanket bogs is not yet considered to be an economic undertaking, primarily because they are too shallow.

Current research and development efforts are being concentrated on improving production capacity and optimizing the use of natural drying conditions, both of which would help to lower the costs of the end-product. It is now becoming crucial that fuel peat costs be kept as low as possible because of the increasing competitiveness of low-cost, imported coal and natural gas.

Bord na Mona estimates that it will supply peat products until around 2030. Based on current projections, milled peat production will peak in 1990 and will then decline as deposits are slowly exhausted. Briquette production will be maintained at a peak level until 2010 and will then decline gradually. Sod peat production will end around 2006.[31] Factors which could change these predictions depend on a change in energy policy in Ireland. Natural gas, nuclear energy and the falling price of imported coal will most likely receive consideration. Changes in harvesting technology and uses could also alter this production timetable.

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[29] Bord na Mona, 36th Annual Report, 1981/1982 (Dublin: Bord na Mona, 1982).

[30] Bord na Mona - Personal Communication 9 April, 1984.

[31] Ibid.

The newest development in the Irish peat industry is small-scale, fuel peat production. The Irish peat industry has, until very recently, been a monopoly of Bord na Mona. The Turf Development Act 1981 established a grants-in-aid program, administered by Bord na Mona, to encourage the development of a small-scale production peat industry. Funds are awarded to individuals, usually farmers, or cooperative groups wishing to develop small areas of privately owned peatland. As of 1983, 256 schemes totalling 11,765 ha had been approved for development and 1,250,000 IRL (approximately $800,000 Cdn.) had been awarded. The development of this industry has also led to an increased demand for small, tractor-operated machines, particularly the sod peat extruder models. Four companies are now manufacturing machines for bog drainage and preparation, turf production and harvesting. Bord na Mona's responsibilities have also increased in respect to this program to include advisory and survey services.

Agriculture

Many peatland regions in Ireland have been used for agriculture. This was particularly widespread in the 19th century when land was scarce and the most widely cultivated crop was the potato. During recent years, attention has been directed toward introducing modern agricultural methods on marginal lands, including peatlands. This is an agricultural policy which has been introduced by the European Economic Community (EEC) and which aims at development of disadvantaged areas in its member countries.[32] The west of Ireland is considered to be such an area.

The entry of Ireland into the EEC in 1974 had a major impact on the country's agricultural development. Many aspects of the EEC policy were adopted in Ireland's national policy and have led to numerous projects designed to improve agricultural productivity to a level where farm wages equal those of industrial workers. Such projects have been concentrated in the following areas:

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[32] European Economic Community, Relaunching Europe: agricultural policy, target 1988 (n.p.: n.p., 1982) p. 7.

- drainage and land improvement, involving the expansion of field and arterial drainage programmes, with particular emphasis given to problems in the west of Ireland

- land structure reform, which aims "to help expansion of small and medium sized family farmers and to see how best they can be enabled to acquire some extra land where they need it".[33] Land structure reform is the responsibility of the Land Commission (originally established in 1881). Its current schemes include i) the EEC Farmers Retirement Scheme, which encourages farmers to sell their land to the Land Commission for eventual redistribution, and ii) the EEC Farm Modernization Scheme, which distributes land to farmers who show the need for extra land to improve income and which provides state aid and capital grants for improvement works including farm buildings, roads, fencing, field drainage and water course alteration. Due to its disadvantageous position geographically, the west of Ireland receives special attention by way of extra development schemes. They cover such concerns as land improvement in mountainous and hilly regions, lowland drainage and reclamation, improved grazing lands, etc.

Many of the land improvement schemes have direct applicability to the reclamation of blanket bogs and (cut-over) raised bogs since the improvement techniques require drainage and reclamation.

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[33] Irish Government, Programme for National Development 1978-1981 (Dublin: Stationery Office, 1979) p. 122.

The Department of Agriculture is the main agency responsible for the development and general implementation of agricultural policy. In addition, other related agencies holding more specific responsibilities are involved in agricultural development in Ireland. These include:

- An Foras Taluntais (the Agricultural Institute) whose functions are to review, encourage, coordinate, promote and undertake agricultural research, including horticulture and forestry. The Institute operates a number of research stations. The station at Lullymore in Co. Kildare is responsible for research into the agricultural use of peatlands and reclamation of cut-over bogs.

- An Comhairle Oiliuna Talmhaiocta (ACOT), an organization composed of a number of regional offices which provides advisory services and coordinates agricultural training and education.

- County Committees of Agriculture which administer the various land development schemes.

- Farmers organizations, the main ones being the Irish Farmers Organization and the Irish Creamery Milk Suppliers Association.

Peatlands are generally considered to be marginal lands in terms of agriculture, and in Ireland, peatlands comprise approximately one-third of all marginal lands. Blanket bogs (primarily mountain blanket bog) and virgin lowland bog can be used for rough pasture or reclaimed for grassland, if they have been previously cut-over. Virgin raised bogs are not suited for agricultural purposes, but cut-over raised bogs can be reclaimed. Their agricultural potential depends on the kind of peat exposed and the depth of peat left after cutting. Sphagnum peat is suitable only for grazing but where fen peat is exposed, these areas can be converted to produce a range of agricultural and horticultural crops.

The focus of peatland agricultural development in Ireland is twofold: the use of virgin peatlands for rough grazing and the reclamation of cut-over bogs for either grassland or vegetable production.

For the purposes of rough-grazing, the land is not reclaimed, meaning it is not drained. The productivity of virgin peatlands is very low, due to the high acidity and low nutrient content of the peat material. Plants growing on deep peat do not have contact with the underlying mineral soil and thus suffer from nutrient deficiencies. This results in poor grazing, particularly for sheep, which are the animals most frequently grazed on rough peatland pastures.

An Foras Taluntais (The Agricultural Institute) is responsible for studying and developing methods which can be used to improve peatlands for agriculture. Most of the work is still at the experimental stage, being carried out on small plots, and has not yet been tested in large-scale application. Improvement of blanket bogs probably presents the greatest difficulty because of their generally poor suitability for agricultural purposes. This is also aggravated by the cooler, wetter climate in the west of Ireland. In an attempt to improve the productivity of blanket bogs, experiments have been carried out using the following methods: fertilization; fertilization and seeding; drainage, deep ploughing and mixing-in of subsoil; and grading. None of these methods have been shown to be economical or technically feasible on a large scale.

Cut-over areas might be reclaimed for forage crop production, vegetable production and beef cattle production, and An Foras Taluntais has investigated the suitability of cut-over peatlands for these uses. After numerous trials involving the various options, the greatest success to date has been obtained with beef cattle production on grasslands. Much of the research has been carried out in cooperation with Bord na Mona.

Forestry

During the past twenty years, peatland afforestation has become an essential part of the national afforestation program in Ireland. Afforestation is the responsibility of the Forest and Wildlife Service of the Department of Fisheries and Forestry. The state forestry programme involves acquisition and planting of lands, management of forest tree nurseries, maintenance of state plantations, marketing of forest products and promotion of an increased use of home-grown timber. The programme also involves a promotion of private forestry through financial and technical assistance, and the control of forestry operations on privately-owned forested lands.

Early state forestry policy was aimed at achieving self-sufficiency in forest products. In 1907, a government commission recommended that 120,000 ha of mountain land be purchased, two-thirds of which were to be planted over the following 40 years. This marked the beginning of the Irish state afforestation programme. In 1943, the national objective of both state and private afforested lands was raised to 280,000 ha. In 1948 the target increased to 400,000 ha, to be planted over the next 40 years. In selecting lands for afforestation, the (then) Forestry Division was required to abide by a policy established in 1926, whereby "The department does not desire to acquire for afforestation, land fit for agricultural purposes which might be capable of being used to form new holdings or enlarging existing ones. With a view, therefore, to preventing such land being acquired for afforestation they have fixed a maximum price at such a figure as to render its sale to the department for this purpose an uneconomic transaction".[34] Because of this restriction, agriculturally-productive areas were avoided. However, lands selected in the surveys as plantable were mainly used for rough grazing so that a conflict of interest was foreseeable. In view of this potential conflict, the Government of Ireland requested that the Food and Agriculture Organization (FAO) reassess the surveys. The FAO published a report in 1951 suggesting that 380,000 ha be planted over the next 40 years.[35] One half of the programme would be "commercial" providing Ireland's national timber needs, and the other half would be "social", providing employment in the west of Ireland. Since the proposed earlier target of 400,000 ha was in agreement with the FAO recommendation, this figure was retained and formed the basis of the current policy regarding afforestation.

The Forestry Acts of 1946 and 1956 give the Department of Fisheries and Forestry compulsory powers for land acquisition. However, with the exception of difficult cases where commonages are to be split up and the majority of farmers are willing to sell, all land acquisitions have proceeded on a price volunteer basis. A retiring farmer or land owner approaches the Department with the intention of selling the land. In accordance with the 1926 policy regarding the sale of land, the Department has been bound to a fixed maximum per ha which could be offered on a parcel of land. Since this price has been far below the actual market value of the land, the Department cannot compete for good land on the open market. Thus, only less-productive land - primarily mountain and low blanket bog in the west of Ireland - has been planted. In 1967, a new pricing system was introduced, whereby the land is assessed for its potential production value and a price fixed accordingly. The owner may or may not wish to sell at this price. If a much higher price is requested, approval for purchase must be obtained from the Department of Finance. Turbary rights (hand-cutting of peat for domestic fuel purposes) are guaranteed and areas of peat are put aside for this purpose.

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[34] Convery, F.J., Irish Forestry Policy National and Social Council. Report No. 46 (Dublin: Stationary Office, 1979).

[35] Food and Agriculture Organization, F.A.O. - forestry mission to Ireland-Irish afforestation programme. F.A.O. report (Washington: F.A.O., 1951).

Upon joining the EEC, land prices rose. This resulted in a further move to the acquisition of marginal land and sub-marginal soils such as gleys, peaty podzols and blanket bogs.

Now, a large part of the state afforestation programme is concentrated on peatlands - primarily lowland and mountain blanket bog - although planting is also now occurring on cut-over raised bog. As of 1982, an estimated 300,00 ha of peatlands have been planted. The government target is now 500,000 ha; of the 200,000 ha which remain to be planted, approximately 100,000 ha will be virgin blanket bog.

The afforestation of virgin bogs is becoming a concern to conservationists in Ireland, particularly since a large portion (approximately 80 percent) of the virgin raised bogs have been developed and cut-over by Bord na Mona. A possible solution to this potential conflict may be to encourage research into the afforestation of the cut-over sites. Current experiments are yielding good growth responses, particularly from sitka spruce, providing that approximately 1.0 metre of undisturbed peat remains. (Currently, Bord na Mona mills peat to such a depth where only 0.5 metres remain.)

The reclamation of cut-over peatlands has developed into a major research concern in Ireland. Several options have already been discussed above, including forage crop production, vegetable production, beef cattle production and forestry. Other alternatives include biomass production and amenity area development. There are a number of problems associated with all of these options, such as low soil fertility, poor economic return (due to low market demand) or a lower level of labour-intensity incapable of replacing the jobs lost after peat production ceases. An interdepartmental committee has been established to study the problem of peatland reclamation. The committee includes members from the state Departments of Energy, Agriculture, Fisheries as well as Forestry and Bord na Mona and An Foras Taluntais. An Foras Taluntais has become the main research organization responsible for studying the use of cut-over peatlands.

The industrial use of peatlands and the recent concern over the acceleration of afforestation of virgin blanket bogs has led to the recent development of a National Peatland Protection Program managed by An Taisce. In 1982, the National Peatland Conservation Committee was established to oversee this activity. The aims of the committee are to:

1) promote a bog conservation programme in Ireland and ensure the preservation of a representative series of Irish peatlands

2) encourage state and semi-state organizations involved in peatland development to acknowledge the conservation and amenity value of peatlands

3) oversee the management of protected peatlands

4) secure funds for the purchase of reserves - possibly through the European Environmental Bureau and EEC organizations responsible for conservation

5) foster public interest in peatlands

6) provide educational material on peatlands

Much of the concern of the committee is centered on the utilization of the raised midland bogs, primarily by Bord na Mona, of which only 21 percent of the original areas remain intact. The most extensive bogs have already been cut-over. Peatland protection is difficult to achieve at the moment since Environmental Policies regarding peatlands are vague and no single government agency is charged with this responsibility. The Wildlife Section of the Department of Fisheries and Forestry is responsible for the establishment of nature reserves. The State Office of Public Works is responsible for the protection of peatlands in National Parks. Local authorities are responsible for the protection of peatlands in more general amenity areas. There are also major conflicts of interest within the above-mentioned agencies. The Wildlife Section is a minor part of the State Department (Fisheries and Forestry) which spends a major portion of its budget on afforestation of peatlands. Already, one area considered of scientific interest by the wildlife section has been afforested by another section of the same department. The Office of Public Works, responsible for protecting peatlands in the National Park System, is also responsible for extensive arterial drainage schemes which have caused severe damage to Midland raised bogs.

The Protection Program is enjoying cooperation from a variety of agencies in Ireland. The Forest and Wildlife Division of the Department of Fisheries and Forestry expressed a willingness to aid in the management of peatland reserves. Bord na Mona has donated two raised bogs to An Taisce and has agreed to set aside other sites for conservation. European countries have shown strong interest in the Program. Contact with European International agencies and fund-raising groups is being managed through Dutch conservation bodies, the European Environmental Bureau and EEC organizations responsible for conservation.

iv) Finland

Peatland development in Finland is directed primarily toward two distinct areas: peatland forestry and fuel peat production. The development of both areas of activity has been strongly aided through government policies and programs.

Forestry represents the most extensive use of peatlands in Finland. Research activities in this field have been heavily involved with improving forest yields through the development of proper drainage techniques and, to a lesser extent, fertilization. Currently, 5.5 million ha, of a total peatland area of 10 million ha, have been drained. It is intended that by 1990 a total of 6.5 million ha of peatlands will be drained and managed for forestry purposes.

Drainage work is carried out on both state and privately-owned peatlands. The earliest activity on state-owned land began in 1908 and was conducted by the (then) National Board of Forestry. In 1928 the Forestry Improvement Law was passed to enable the government to direct public funds to support forest improvement operations on privately-owned lands - farmers being the main private land-owner group. Drainage was, and still is, the most significant forest improvement measure supported. The same law continues to be in effect today.

All drainage activities must be planned by or under the supervision of the Central Forest Board or District Forest Board. They must meet standards so as not to interfere with any nature conservation areas which exist in the region. Funding is awarded either as a grant, a loan or an advanced payment for drainage activities from the forest improvement funds via the Forest Improvement District in which the land occurs.

State forestry is the responsibility of the National Board of Forestry, a branch of the Ministry of Agriculture and Forestry. Reclamation of privately-owned land is conducted by the Central Forestry Boards (Tapio in Finnish-speaking districts and Skogskultur in Swedish-speaking districts). Approximately 63 percent of the total forest area is under private ownership and thus the main forest drainage activity is carried out on private peatlands. The Central Forestry Boards and their Departments of Forest Improvement and Forest Improvement Districts are largely financed through state aid in accordance with the Forestry Improvement Act.

Peatland drainage is strictly regulated by the Water Law (264/61), and supervision of this activity is the responsibility of the National Board of Waters, Ministry of the Interior. All reclamation plans must be approved through this Board and assessed for the adherence to the guidelines of the Water Law.

The National Board of Agriculture, the Agricultural Research Centre and the Finnish Forest Research Institute are also under the authority of the Ministry of Agriculture and Forestry. The reclamation of peatlands for agriculture is no longer carried out in Finland, so that the importance of the two agricultural institutes is minimal with regard to peatland development. However, they do continue to provide some soil analysis services applicable to forestry practices. Government forestry research is the responsibility of the Finnish Forest Research Institute where the Department of Peatland Forestry is responsible for studying all aspects of forest production on peatlands.

Peat production (primarily fuel peat) has experienced recent, rapid growth in Finland as a result of the 1979 Energy Policy Program and its amended form, the 1983 Finnish Energy Policy Program. The most significant aspect of the Finnish National Energy Policy Program, as it relates to peat, is the intent to decrease dependency on imported fuel sources through the development of indigenous fuel sources (primarily hydropower, wood and peat). At present, approximately two percent of the country's energy requirements are being met with peat (approximately 0.50 Mtoe annually).

Fuel peat in Finland is produced mainly as milled or sod peat. Peat briquettes and peat coke are used to a lesser extent. Milled peat is used to fire larger boilers for district heating plants, whereas sod peat and peat briquettes are produced for small boilers and single-unit furnaces. In order that the fuel peat industry in Finland continues to develop, it is essential that peat be kept at a competitive price, particularly compared with coal. Therefore a great deal of research effort is aimed at improving bog production capacity, peat-processing methods and handling systems through greater mechanization.

The Ministry of Trade and Industry is responsible for the administration and financing of all aspects of the technical development, production and use of peat. The Technical Research Centre (VTT) and the Geological Survey of Finland are the two branches of the Ministry active in all aspects of the research and development of the use of peat as a raw material. However, current research interest and activity is directed primarily toward fuel peat.

There are no laws which regulate the use of peatlands for peat production, although there are a number of land acquisition laws which control the rights to procure land for the purpose of utilization.

Peatlands in Finland are owned by the State, municipalities, parishes, companies and other institutions as well as private persons. During a period of general land reallotment in Finland, each land owner received a proportion of the different land-capability classes. Thus, in addition to receiving fields and forests, participants also acquired portions of waste land; bogs were included in this category. This has resulted in a scattered ownership of peatland, with larger peatland areas having in some instances hundreds of owners. Only the State owns larger areas of continuous peatland.

Before peat production can begin, a peat producer must either own the land or have gained rights to utilize it. A peat producer can also rent peatland from a landowner but, considering the number of different land owners involved, it can take a considerably long period of time before the rights to an entire area can be acquired. Thus, state-owned peatlands are the primary areas of peat production, the State Fuel Centre (VAPO) being the largest fuel-peat producer.

Private peat companies may be given the right to develop state-owned peatlands on contract under the Law Concerning the Right to Surrender the Land Property and Revenue-Yielding Rights (687/78). Rights are granted only if the use does not interfere with government peat production, nature conservation or building plans. Since VAPO has already acquired most of the peatlands suitable for peat production, very few contracts with private producers are made.

Peatland protection is regulated under the Nature Conservation Law (71/23). Areas designated for protection are either natural parks, national parks or peatland conservation areas. Most parks have been established by laws set in 1938, 1956 and 1981. Peatland protection areas are new forms of conservation lands, and the first areas were conserved in 1981. Protection of state-owned land is established by law or by statute, depending on the size and significance of the protection area concerned. The protection of privately-owned land is carried out by provincial governments. A private land owner has the right to compensation from the state for the economic loss due to the conservation of his land if peat production is an alternative. Compensation is not subject to consideration and must be paid if demanded by the land-owner.

There are a large number of institutes, agencies and societies involved wholly or partially in peat and peatland research in Finland. These include the following:

The Finnish Society of Peatland Cultivation:
Founded in 1894, this Society is the oldest organization in Finland involved in peatland utilization. Its purpose is to promote all potential uses of peatlands. In the past, the Society carried out soil surveys in order to assess the distribution and extent of peatlands and their suitability for agricultural reclamation. The Society has, since its beginning, been involved in numerous studies involving drainage, soil improvement and soil fertilization.

Agricultural Research Centre:

Certain departments of this centre are involved with peat. The Institute of Soil Science has investigated the distribution of different kinds of peat deposits and their plant nutrient contents. The Institute of Agricultural Chemistry and Physics studies fertilizing and improvement of cultivated peat soils. Plant production on peatlands is studied at a number of research stations throughout Finland.

The Finnish Forest Research Institute, Department of Peatland Forestry:

The Institute is part of the Ministry of Agriculture and Forestry and, since 1928, the Department of Peatland Forestry has been conducting research into the utilization of peatlands for forestry purposes. The research activities are carried out at research stations under the control of the Forest Research Institute. Research activities are divided into five categories and include: properties and classification of peatlands; forest hydrology; ecology and silviculture of peatland forests; forest fertilization on peatlands; and forest technology.

Technical Research Centre of Finland (VTT):

This centre is concerned with the research and development of domestic energy - principally peat, wood and biomass. Research is carried out at two laboratories - the Fuel and Lubricant Laboratory and the Domestic Fuel Laboratory. The Fuel and Lubricant Laboratory is responsible for research on peat processing including peat gasification and liquification, thermal treatment of peat, compressed peat products, peat extracts and horticultural peat products. The Domestic Fuel Laboratory is concerned with production and handling research, including: peat production techniques, wood production techniques; domestic fuel handling techniques; combustion and combustion plant design; environmental impact measurement; and systems analysis. In addition, both laboratories conduct production studies in cooperation with industry, including such projects as pilot-plant investigatons, field experiments, laboratory analysis services, economic analyses, and mathematical modelling.

The Geological Survey of Finland, Department of Quaternary Geology:

The Peat Research Group of the Department of Quaternary Geology is responsible for work in the following areas:

1) peatland inventory and mapping of peatlands as quaternary deposits, peatland genesis, peat classification and resource inventory;

2) the study of macrofossils, mainly pollen and diatom analyses to obtain information on biostratigraphy and paleoecology; and

3) radiocarbon dating

The University of Helsinki, Department of Peatland Forestry:

The Department of Peatland Forestry has been active since 1944 and, in addition to academic education, conducts research into peatland forestry. Recently, research topics have been concerned with timber production on peat, afforestation of peatlands, silvicultural problems associated with peatland forests, the use of fertilizers on peat soils, forest hydrology and the environmental effects of forest drainage.

University of Helsinki, Department of Botany:

This department is involved in the regional study and classification of peatland types and the use of vegetation communities as classification tools. The Department is also concerned with the detailed study of peatland ecology and plant communities for the purpose of assessing the suitability of peatlands for preservation. The department operates a field station where studies have been carried out on the comparison of virgin bog conditions with forest-improved systems.

University of Oulu, Department of Botany:

This department operates a field station in north central Finland where peatland research has been directed toward the ecology and classification of sub-arctic peatlands.

The Soil Fertility Service:

This service carries out physical and chemical analyses of soil, plant and water samples for government and private industry. Chemical, physical and microscopic studies are performed on peat to determine its suitability for use as a soil improvement material.

Finnish State Fuel Centre (VAPO):

This state-owned organization is the largest fuel peat producer in Finland. The R&D department was established in 1982 to investigate the production technology of wood and peat. In the case of peat, studies include the preparation of production areas, production techniques, transportation and fuel refining.

Peat Research Institute:

This Institute, founded in 1966, is a privately-owned institution. The main interests of the Institute have been to develop the horticultural uses of peat. In this context, the properties of different types of peat and their suitability for horticultural purposes have been investigated, standards have been developed and methods for determining peat type suitability for horticultural use have been studied. Special peat horticultural products and peat culture techniques such as watering, liming, fertilizing and automation have also been developed.

The Association of Finnish Peat Industries:

This association, founded in 1943, promotes the expansion of the peat industry and the utilization and processing of peat for horticultural purposes. The association operates as a liaison between the government and its member peat producers and provides technical and marketing advice through consulting services, seminars, training programs, etc. The association has a membership of 28 producers and 184 supporting and individual members.

v) Sweden

Current emphasis in Sweden is being placed on the development of fuel-peat production. This emphasis is in direct response to energy policy decisions of 1975 and 1979 which led to the 1981 Energy Bill. The goal of Swedish Energy Policy has been to move away from the country's strong reliance on imported oil, and to develop a greater reliance on indigenous fuels - primarily forest residue products and peat - in combination with greater energy conservation measures. Sweden's own reserves of conventional energy sources are very limited. There is almost no oil, gas or coal in the country, and although there are considerable uranium reserves, the country's nuclear energy program will not be developed any further once existing plants are completed. Hydroelectricity is the single most important indigenous energy source. Peat and forest residues are the most important solid fuels. Prior to 1975, these solid fuels did not contribute significantly to domestic energy use. By 1981, they contributed 8 percent (or 4 Mtoe) and by 1990, their combined contribution is projected to reach 7 Mtoe.

The new Energy Policy led to the establishment of the Energy Research and Development Commission (now the Energy Research Commission), which was organized as a committee under the Ministry of Industry. Funding is made available through this commission for the Research and Development of peat as an energy source. Prior to this time, peat had not been studied in Sweden as a fuel and had been used only as a horticultural medium.

Since 1975 the Energy R&D program has been implemented in a series of three-year programs comprising the Main Program for Energy Research and Development. From 1975 to 1978 and 1978 to 1981, emphasis was placed on the investigation of alternative energy options. During the most recent 3-year period, 1981-1984, the above investigations were concluded, and plans for large-scale demonstration projects have been proposed and developed. These deal with wind energy and the production, conversion and end-use of peat and forest residues. These projects will be carried out in the fourth period from 1984-1987.

The Main Program consists of six sub-programs:

1. Energy use in industrial processes
2. Energy use for transportation
3. Energy use for buildings
4. Energy supply
5. Energy systems studies
6. Fundamental research

Government agencies are appointed to manage these sub-programs, but the major proportion of the research and development is carried out on contract by universities, research institutes, and consulting firms. Peat Research and Development falls within the Energy Supply Sub-Program, which is concerned with all aspects of energy production, conversion and distribution.

From 1975 to 1983, Naemden foer Energieproduktionforskning - N.E. (National Swedish Board for Energy Source Development) was the agency responsible for all forms of peat R&D. In July, 1983, this agency was disbanded, and the bulk of its responsibilities were transferred to the newly-formed Statens Energiwerk - S.E. (National Energy Board), which is now responsible for administering the Energy Supply Sub-Program.

The goal of the Energy Supply Sub-Program has been the development of technology and the survey of costs and other conditions related to the utilization of renewable and indigenous sources of energy. The Energy Supply Sub-Program is organized into eight components: Forest Energy - Peat; Energy Plantations; Fuel Conversion; Combustion Plants; Wind Energy; Advanced Technologies; Supply Systems; and Fusion.

Research efforts in the Forest Energy - Peat program include R&D on the production and preparation of fuel, commercial sales and distribution of peat and forest residue and the combustion of all types of biomass fuels in small and medium sized plants. Peat and forest residues are considered to be the most attractive indigenous fuels since they appear to be capable of satisfying the objectives of the National Energy Policy by providing a substitute for oil in a relatively short period of time.

The specific goals for the next 3-year period (1984-1987) include the further development of technology (particularly for artificial dewatering), demonstration projects and field experiments, market studies and environmental impact assessment of peat production and emissions from boilers.

Work within the Forest Energy - Peat sub-programme is organized into four main areas: system aspects; peat production; combustion; and forestry fuel production. Peat R&D is handled in the first three of these four areas.

System aspects relate to the overall conditions and problems associated with the use of peat and forest energy and the assessment of the projects in the sub-programme. Peat production includes the development of projects for peat inventory, the study of methods for extending peat production to a year-round operation, artificial dewatering technology and fuel preparation such as solid fuel-peat pellets and briquettes (milled peat production is not treated under this program since this area has already been developed to a great extent in the horticultural industry). The combustion sub-programme involves the short-term development of fuel efficient and environmentally acceptable combustion plants for peat and other biomass fuels.

Further peat R&D is carried out less intensively within the framework of other sub-programs. The fuel conversion sub-program deals with the gasification and liquefaction of peat, forest products, shale and coal. In the 1981-84 period, efforts were directed mainly toward wood products and peat. As a result, a small-scale gasification demonstration unit was installed and is now operational.

The Combustion Plants Sub-Programme concentrates on developing new technology for the combustion of solid fuel and improving the environmental safety standards (particularly problems of reducing emmissions from solid fuel combustion). A major aim is to develop and test new technology which permits the use of both coal and indigenous fuels in medium and large-sized boilers. Peat is seen as having the greatest potential for use in medium and small-sized boilers, particularly in district heating units and boilers for individual, multi-unit buildings, hospitals etc. Peat and wood residues will be used for heat production only and not electricity.

In order to promote its energy policy and to encourage the development of indigenous fuels in the private sector, the government introduced the Oil Substitution Program and the Oil Substitution Fund (Government Bill 1980/81: 49). The Fund provided financial assistance in the form of loans or grants from January 1981 to December 1983. The bill was further modified to expand the program to the end of December, 1984. The intent has been to stimulate investment in the oil substitution field by supporting efforts to replace oil with peat, wood chips, biomass, coal, synthetic fuels, etc. The fund is financed by a special tax on oil and oil products (excepting gasoline).

Within the context of this program, several measures have been taken which are specifically related to peat. Prior to 1982, little interest was shown by the private sector in investing in peat production. This was understandable considering that there was no market for fuel-peat in the country. In order to encourage the use of peat, particularly as a solid fuel in district heating units, a bill was passed in 1982 which provided a 25 percent government subsidy to any successful applicant who wished to construct or begin construction of peat-fired heating plants during 1983. As a result of the program, there are now 60 peat-fired plants in various stages of planning, construction or operation and ranging in size from 1 MGW to 100 MGW operating capacity. This subsidy program was extended to the end of 1984, during which time the subsidy was reduced to 15 percent, but extended to include forest residues as well as peat. In addition, a separate program was established in northern Sweden which allows for a 25 percent subsidy for both peat and forest-residues until 1985. These subsidy programs are administered by the National Energy Board. A further incentive was introduced as of January, 1984 allowing for the exception of indigenous fuels from sales tax in order to promote the sale of solid fuels within Sweden.

One particular problem which relates to the Swedish subsidy program and the development of a fuel-peat industry is the tendency for communities to construct plants which can burn different types of fuel (peat, wood chips, biomass) depending on which fuel is available at any given time for the lowest price. The original terms of the subsidy program required that these plants burn 50 percent peat for 24 months, after which they could choose which fuel they would use. In many areas, wood chips and sawdust are readily available from sawmills, are currently cheaper than peat and are easier to produce. The new amendment to the fund does not improve the situation for peat. Without guaranteed long-term customers, it is very difficult to establish a fuel peat production industry. The amount of time and investment required to begin peat production is much higher than that for wood products. It is therefore likely that wood chips will be more attractive due to their greater availability and lower cost.

Government administration of energy programs, including peat, is the responsibility of the Department of Energy, Ministry of Industry. However, the majority of projects and programs concerning energy development are referred by this department directly to the National Energy Board.

The Mineral Division, Ministry of Industry, is responsible for issuing permits and licences for the production and utilization of fuel-peat (a permit is not required for horticultural peat). This process can take up to several years to complete and therefore is considered detrimental to the growth of a new peat-producing industry. A Peat Sub-Committee has been set up to determine how licencing might best be administered and it is expected that special provisions for peat, or a "Peat Law" will be included in the new energy guidelines to be released in the spring of 1985. Part of this law may transfer the licencing authority from the Minerals Division to the local or community governments.

Based on the recommendations following a case study recently carried out by the National Energy Board, the Department of Energy is now planning the development of a domestic fuels company. The company would be located in northern Sweden and would be owned and operated jointly by the state and by local communities. It is tentatively planned to include this proposition in the 1985 energy guidelines.

The environmental aspects of peat development are being studied mainly by the Swedish Environmental Protection Agency. The agency works in cooperation with university researchers and other groups to study and monitor the impact of development on bog systems and surrounding areas, particularly with regard to hydrology and changes in plant communities. Concern is now being expressed over the type and control of emissions from peat-fired plants. A very recent government bill has set a limit for sulfur emission from coal-burning plants and suggests that all plants which burn solid fuels should adhere to the same sulfur emission limits. This would include peat. The Department of Energy is now proposing to study the limits which should be set on peat and how best to achieve them. The study will be carried out by the National Energy Board.

The National Energy Board and the Department of Energy are not the only agencies in Sweden involved in peat Research and Development. However, because of the renewed interest in fuel-peat since 1975, energy Research and Development received the greatest prominence.

During the late-60s, considerable work was carried out to establish the horticultural peat industry in Sweden. Research was conducted primarily by the two largest horticultural peat producers in Sweden: Hasselfors Garden AB - a private company and Svenska Torv AB - a crown corporation owned by the Swedish Forestry Service. The state-owned company is organized into one head company, Svenska Torv AB (the Swedish Peat Company) and two subsidiaries: Svenska Torv Skaane AB (Swedish Peat Company Skaane), and Svenska Torvfoeraedling AB (Swedish Peat Refining Company).

The Swedish Peat Company is responsible for establishing fuel-peat production activities wherever suitable opportunities exist in the country, outside the province of Skaane. Major production areas are currently established in south central and south eastern Sweden. The Swedish Peat Company Skaane is responsible for horticultural peat-moss and fuel-peat production in Skaane. The Swedish Peat Refining Company is concerned with developing alternative uses for peat other than energy, improving or developing new methods of peat extraction, and extending the production year to a year-round operation through improved production and dewatering technology.

The Swedish Foundation for Peat Research was formed in 1983, in response to the development of the small, but growing fuel peat industry. This group will perform applied research in peat development, almost exclusively fuel-peat, and is currently negotiating with the National Energy Board to organize a basic research program.

The Swedish Peat Producers Association was also established in 1983 and its membership includes both fuel and horticultural producers. The main tasks of this association are to organize marketing strategy and to provide a liaison between the government and the producers.

The creation of these associations concludes what many perceive to be the end of the first phase of development of the peat industry in Sweden (1975 to 1983).

vi) Germany

Germany has had a very long history of peat-production. This began approximately 2,000 years ago with the agricultural use of niedermoore, or fens, and progressed to the development of a variety of techniques for the agricultural use of hochmoore, or raised bogs, during the period 1600-1900. The systematic harvesting of fuel-peat began as early as 1500 and the industrial uses of peat, peat briquette production, peat-coke and charcoal were all well-developed industries in Germany by the end of the 19th century.

Fifty percent of the peatlands in Germany are found in the northern German province of Niedersachsen, Lower Saxony. Seventy percent of all raised bogs occur in this same area and a full 90 percent of the total German peat-production is located here. The second most important peat producing region is in the southern German province of Bayern, Bavaria.

Whether for agricultural purposes or for horticultural peat-production, peatlands are used intensively in Germany. Such intensive use has led to a very strong, negative reaction in the country and the growth of a very vocal and persuasive peatland protection movement within the general nature-conservation group. This reaction is understandable, considering the fact that the few remaining, intact peatlands (or, more specifically, raised bogs) are amongst the last of the undisturbed natural areas to be found in Germany. Even more importantly, they are regarded as wetland areas - a very rare ecosystem in the country. Therefore, the important issue regarding peat-oriented policy, development and research in Germany today is the need to resolve the conflicts between conservation interests on the one hand, and the horticultural peat industry and peatland agriculture interests on the other hand. This is a particularly difficult problem, because the conservation groups' emotional response have created a highly political issue and a sensational media coverage.

Major Actors in Peat Research and Development

Niedersaechsisches Landesamt fuer Bodenforschung - The Lower Saxony Soil Research Office

Two Institutes within this centre comprise the main peat research groups in northern Germany. The *Office for Peat and Coal*, formerly the *Peat Research Institute*, located in Hannover, is responsible for studying peat as a raw material, for resource evaluation, mapping and economic studies. This office has recently published a comprehensive report on the current situation of the peat industry in Lower Saxony and on the options for any future development or growth. Particular attention is now being directed toward establishing the location of any remaining raised bog areas which may be available for future production. This has been done in very close association with the *Department of Nature Protection* of the *Lower Saxony Ministry for Nutrition, Agriculture and Forests*. The project consisted of mapping all peatlands in the province and delineating all areas currently under production. All remaining areas were then classified according to their value and importance for being designated as conservation areas not available for production. Any remaining areas could then be considered for future production. This assessment is available in map form at a scale of 1:25,000 and was completed in 1980.[36]

The *Soil Technological Institute* began in 1877 as the *Peat Research Station* in Bremen. Its responsibilities then included the development and improvement of techniques for the agricultural and forestry uses of peatlands. As a result, the Institute developed three major agricultural techniques for peatlands:

- German Hochmoorkultur - the improvement of farmland on raised bogs through drainage and fertilization (with manure);

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[36] Birkholz, B.E. Schmaltzer and H. Schneekloth. *Naturschutz und Landschaftspflege in Niedersachsen - Untersuchungen an nedersaechsischen Torflagerstaetten zur Beurteilung der abbauwuerdigen Torfvorraete und der Schutzwuerdigkeit im Henblick auf deren optimale Nutzung* (Hannover: Niedersaesischen Landesverwaltungsamt, 1980.)

- Sandmischkultur - the improvement of either partially harvested bogs or level fens by mixing sand from the underlying mineral soil with the overlying peat;
- Sanddeckkultur - farmland improvement by spreading sand over the cultivated peat surface, without mixing.

Agriculture continues to be a major research interest today and the Institute is still concerned with improving yields from both fens and raised bogs. The currently favoured technique is "deep ploughing" to a depth of 2.5 meters in order to bring the underlying sand to the surface and mix this material with the peat. The Institute is also involved in peatland reclamation. The current pressures for protecting and increasing natural areas, have led to research in regenerating raised bogs on cut-over peatlands. This is achieved by encouraging the growth of new sphagnum on peat remaining at the base of the bog and by controlling the hydrology of the artificially-created basins.

The Department for Nature, Bird and Landscape Protection, Lower Saxony Administrative Offices:

This Department is responsible for studying and selecting peatland areas for conservation and preservation and for ensuring that the regulations of the Lower Saxony Peatland Protection Program (1981) and the Nature Protection Law (1981) are implemented.

Peat Research Institute:

This Institute was established in Berlin in 1934 to study and develop uses for poorly-decomposed sphagnum moss. In 1948 the Institute was moved to Lower Saxony and has since served as a research centre for the horticultural industry. Emphasis has been placed on the development of new peat-mixes and fertilizer additives, the use of frozen, fuel-grade peat as a horticultural substrate and the development of industrial norms or standards for the physical and chemical properties of peat. The Institute was most active in the 1950s and 1960s during the greatest expansion period of the horticultural peat industry. Since 1972, the Institute has reduced its staff and responsibilities, but is still active in its research to improve the horticultural use of more humified peat. This will be particularly important if peat-producers are no longer permitted to expand into new areas for peat-moss production.

Peat Industry Association:

The association acts primarily as a liaison between the peat producers and the government. There are approximately 100 members, the majority being medium- and small-scale peat moss producers. In the past, during the most active period of the horticultural industry, the Association served its members by providing information on modern, automated production techniques and on technological developments in harvesting and production machinery. Today, the Association is concerned with ensuring the viable continuation of the industry, particularly in view of the strong nature conservation oriented policies of the government.

One problem which the Association is now addressing is the regulation concerning development deposits. To ensure that proper reclamation schemes are carried out following production, the government requires that a producer pay a deposit of, on average, $1,000 equivalent for each hectare of land to be developed. Such a deposit serves as protection against default on reclamation, should the producer declare bankruptcy. The current, total deposit is approximately $30,000,000, based on a total production area of 32,500 ha. Since it is frequently difficult for the smaller, family-operated businesses to meet the $1,000 per ha requirement, the Association is proposing a new deposit scheme to the Government, whereby a total deposit of $5,000,000 would be accumulated. Producers would pay their portion according to their financial capability. (The assumption is that not all producers will declare bankruptcy and that, therefore, $30,000,000 far exceeds the amount necessary for the insurance.)

Peat Distribution Association:

This Association serves as a central distribution agency and marketing service for approximately 25 producers in Lower Saxony. The Association has a number of standard products which various producers mix and pack under the same brand names. The Association buys the peatmoss from any given member producer - usually dependent on the price quoted by the producer - and distributes it to the end user - usually greenhouses. The Association does not set prices. Prices are generally determined on a competitive basis between producers.

The Bavarian Institute for Soil Cultivation and Horticulture; Division of Soil and Land Management:

This Department evolved from the original Royal Bavarian Peat Research Institute, established in 1900. The earlier Institute was concerned with virtually every research problem involving the use of peat and peatlands in Bavaria, although the main emphasis was placed on cultivation. Today the Department is active in continued attempts to improve agricultural productivity on peat soils and, most recently, is occupied with the problem of resolving the conflict between the Nature Protection and Conservation Groups and the horticultural peat producers and peatland farmers. In this context the Department works together with the Office of the Environment, which concerns itself with the ecological studies of peatlands. As in Lower Saxony, this Department is currently conducting studies into the regeneration of raised bogs following harvesting. Several small areas have been regenerating successfully for the past 40 years without any manipulation of water levels. Study sites which have been regenerating under various controlled conditions for the past five years are showing varying degrees of success.

Two other institutes in Bavaria are involved in peat research. The Institute for Soil Science and Plant Nutrition investigates the applications of different growth mediums composed of peat. The Institute for Water Chemistry and Chemical Balneology studies the use of peat and peat products in therapeutic baths.

Bavarian Ministry for Land Development and the Environment:

This Ministry is responsible for the general administration of the provincial Nature Protection Law 1982, and ensuring, specifically, that remaining intact peatlands are selected and placed under environmental protection.

The German Peat Society:

The German Peat Society, established in 1972, serves as a forum for the exchange of ideas on a wide variety of topics related to peat and peatland research, development and management. Considering the controversial issues which surround peat development in Germany today, it is particularly useful that objective discussion between concerned groups can occur prior to media exposure. The Society publishes a yearly journal, TELMA, which covers German research activities in the main areas of peat and peatland studies.

Regulations Concerning Peatland Development

Peatland development in Germany has been regulated, to varying degrees, since the mid-19th century. The first regulations developed in response to the protest against burning peatlands. From 1600 to 1900, farmers practised a form of pasture land improvement called Brandkultur. The surface of the peatland was burned, releasing nutrients and thereby improving the productivity of the soil. Pasture land treated in this manner had short-lived usefulness, usually lasting 30 years. Burning was conducted in the spring and this method was intensively practised in the farming areas around the city of Bremen. In response to the resulting pollution, the citizens founded the Northern German Society Against the Burning of Peatlands in 1867. The practice continued for several years but was eventually banned in 1913.

Rapid development of the fuel-peat industry in the 1920s resulted in the first Peatland Protection Law in Lower Saxony passed in 1923. This law set a limit of 5 hectares on the production area, required that a licence be obtained for production and that the developed peatland be left in a state suitable for reclamation for agricultural or forestry purposes. In fact, reclamation had to occur as production progressed. The peat moss removed from the upper levels of the bog had to be replaced over the mineral soil of previously-excavated sites and mixed with the underlying sand to produce an arable material.

In 1972, a new Quarrying Law was introduced which was applicable to sand, gravel, clay and peat. The law required that any peat area under production must, upon completion, be returned to a "typical peatland landscape". The newest Nature Protection Law (Lower Saxony, 1983) requires a permit for any peat harvesting on an area greater than 30 m^2 and indicates that new permits will only be issued in those cases where it is possible to regenerate a new peatland after use. The permit procedure can last up to two years in Lower Saxony, but this is purely academic since virtually no new licences are being issued nor are producers being permitted to expand their operations onto adjacent, intact peatlands.

In addition to the Nature Protection Law, Lower Saxony has also approved the Peatland Protection Program - Part I - 1981. The agency responsible for administering this law is the Ministry for Nutrition, Agriculture and Forestry. The basic aim of the Program is the immediate protection of the remaining intact raised bogs (100 percent of the fens in Niedersachsen are under agricultural production). This requires that 30,000 ha (or 55 percent of the currently intact raised bogs) be placed under immediate protection by the end of 1984 and that, following production, a further 30,000 ha be placed under protection to be regenerated as sphagnum bogs. This will result in a total protection area of 600 km^2. The current area of raised bogs in the natural state is 542 km^2 (22 percent of the total area of 2,494 km^2).

The peatlands in Germany are privately owned. However, under this program the landowner will not be permitted the option of developing harvested land for agriculture or forestry; the land must be returned to its natural state. From the perspective of the land owner, such land has no economic value. The government does not buy the land and the land owner is in no way compensated for the loss of any profit which might have been realized if agriculture or forestry were introduced.

The 1982 Bavaria Nature Protection Law follows a similar premise. Peatlands are included within the general category of wetlands. In Bavaria, approximately 75 percent of the 141,000 ha of Niedermoore, or fens, have been cultivated for grazing. Twenty-two percent of the Hochmoore, or raised bogs have been cultivated or harvested for horticultural peat moss. Of the remaining 85,500 ha of undisturbed peatlands, 32,000 ha have been selected as nature protection areas.

vii) The Netherlands

Peat and peatlands have been used intensively in the Netherlands for the past 2,000 years. Agriculture - mainly grazing and later potato production - was the dominant land use until the 1500s when the country entered its "Golden Age". It has been suggested that, during this period, peat provided the domestic energy source which enabled the Dutch to develop into a major world power at that time. It was during the period 1500-1700 that virtually all usable peat in the country was extracted, with the major peat extraction region being south of Amsterdam.

Fuel peat extraction was regulated by the government. During the 1600s a licence was required (in the northeastern part of the country) to remove peat. Even at that time, the licence required that 50 cm peat be left above the mineral soil. This peat was mixed with the underlying sand to produce a very fertile soil which was used for arable farming. This region is still producing vegetable crops today. From 1650 to 1700, a tax was levied on each cubic meter or peat removed. This tax was used to aid in the agricultural reclamation of the harvested land.

In the remaining Dutch peat areas, the peat is either mixed with too much clay or the ash content is too high, rendering it unsuitable for burning. The few virgin peatlands in the Netherlands have been placed under protection.

Today, virtually all research is directed toward improving agricultural yields on peatland areas, particularly on the low-lying peatlands in the southwest and on the higher regions in the north. Both these areas are cultivated as grassland for cattle grazing. This work is carried out by the Institute for Land and Water Management Research, Department of Soil Technology and the Soil Aeration and Soil Classification Sections. Management of peat soils is approached as a water management problem and is regulated principally through drainage techniques. Current research is aimed at new methods of improving the bearing capacity of the soil and thereby extending the grazing season into early spring and late fall. This requires lowering the water levels in the drainage canals and is a technique which is being strongly protested by nature conservation and protection groups.

All studies concerning the ecology of peatlands and peatland regeneration are conducted by the Research Institute for Nature Management.

There are currently no societies or organizations in the Netherlands through which research efforts or different interests in peatland management are coordinated.

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37 J.W. de Zauw, Peat and the Dutch Golden Age: the historical meaning of energy attainability (Wageningen: Department of Land and Water Use, Agricultural University. 1976)

viii) United States

The United States is considered to have the third largest peat reserves in the world, next to the Soviet Union and Canada. Until recently, the United States utilized its peatlands in only a limited manner for agricultural purposes, harvesting 1 million tons of horticultural peat moss per year. The possibility for fuel-peat development attracted attention from the federal government in 1978 as a result of the energy crisis. Since 1978, the U.S. federal Department of Energy has managed a national Peat Program to produce an inventory of the resource, and to develop gasification technology to utilize peat.

The geography and characteristics of the U.S. peatlands are highly varied. They include such diverse environments as the treeless, alluvial, lowland bogs of Alaska underlain by permafrost to the raised sphagnum bogs and basin fens of Minnesota and the northeastern seaboard, and the "sawgrass" peatlands of the Florida Everglades.

Federal Government Departments Involved in Peat Research and Development

Peat Program Policy

The Federal government energy policy has been oriented toward reducing dependence on foreign fuels through synfuel development. In 1978 the United States Department of Energy (DOE) received $4.5 million from Congress under the Alternative Fuels Legislation, to develop a peat utilization program as part of this effort to reduce America's dependence on foreign fuel.[38] As a result, peat research and development has focused on large scale gasification rather than small-scale energy applications. Peat Program activities have been concentrated in the following areas:

- resource estimation
- socio-economic impact assessment

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[38] Melvin Kopstein, "The Department of Enegy Peat Program" in Executive Conference Proceedings Management Assessment of Pe[illegible] as an Energy Resource (Arlington: Institute of Peat Technology, 1979). p. 270.

- environmental impact assessment
- gasification development
- harvesting development
- dewatering development

Based on the results obtained from studies in the above categories, the DOE Peat Program is now oriented exclusively towards the research and development of peat dewatering technology.

Activities and Funding

In 1979 and 1980 DOE spent $1.5 million (1/3 of its Peat Program budget) on state resource inventories, including: Minnesota, Maine, North and South Carolina, Michigan and Alaska. Joint DOE-state inventories were undertaken in Florida, Louisianna, Massachussetts, New York and Rhode Island (1980). Georgia, Wisconsin, and Alabama were added to the program in 1981.[39]

Half of the DOE's Peat Program budget for 1979-80 ($2 million) was spent on a number of activities related to gasification. Minnegasco received $1,013,000 to study gasification, kinetics, wet carbonization, low severity hydropyrolis, and solvent extraction. The Minnegasco DOE peat biogasification project received $383,000. Rockwell received $360,000 for studies on a short-residence-time reactor. The Institute of Gas Technology received $1 million for pilot plant modifications. UOP/SDC Radian Corporation projects and preparation of the DOE perspectus received $244,000.[40]

Environmental and socioeconomic impact assessment received $189,000 for 1979-80. The U.S. Fish and Wildlife Service, Environmental Protection Agency, and the U.S. Geological Survey (which do not themselves, have a peat R&D policy) aided the DOE in preparing a data base concerning the environmertal impacts of using peat as an energy source.

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[39] Ibid.

[40] Ibid., p. 271

Peat gasification and the resource inventory projects continued into 1983. Other phases were completed by 1982. At present, only dewatering research is continuing because it is perceived as the major constraining factor in the large-scale development and utilization of peat as a fuel. Until a dewatering technology is developed to provide a solution to the problem of transportation, DOE believes economical peat utilization will be limited to a 50 mile radius of the peat source.[41]

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[41] Earl Hines, telephone interview, July 10, 1984.

Federal Legislation Pertaining to Peat

There is no federal legislation specifically designed to regulate peat development as an energy resource. However, peatlands and their uses may be regulated under applicable existing legislation.

The 1978 Alternative Fuels Act was used to establish and provide funding for peat research and development through the Department of Energy's Peat Program. In 1980, the Energy Security Act created the U.S. Synfuels Corporation which can provide various types of financial assistance to projects converting peat to any solid, liquid, or gas that can be substituted for petroleum or natural gas. Research and development are not eligible for funding, but land, mines, conversion facilities, transportation systems and power plants are eligible. The Biomass Energy and Alcohol Fuels portion of the Act provide similar types of funding for projects converting renewable organic matter (e.g. wood, cattails, willows, or other crops grown on peatlands) to energy, mostly for alcohol.[42]

Legislation which could constrain fuel peat development is of two types: general laws which affect resource and land use, and specific laws which prescribe acceptable pollution standards for the activities involved in peat development.

The National Environmental Policy Act, administered by the Environmental Protection Agency, belongs in the category of general laws. This Act requires federal government agencies to study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.

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[42] Nancy Holmes, telephone interview, July 3, 1984.

A number of Acts may be used to reserve land from use. The Department of Energy has identified wetland-related Acts (e.g. *National Wetlands Act*, *Coastal Zone Management Act*) as the most significant legislative constraint to peatland development. Other land or resource use Acts which could constrain fuel peat development include: the *Wild and Scenic Rivers Act*, *Waterbed Protection and Flood Prevention Act*, 404 Permit Program under the *Federal Clean Water Act*, *Anadromous Fish Conservation Act*, *Water Bank Act*, *Endangered Species Act*, *National Parks Act*, *National Wilderness Act*, *National Wildlife Refuges Act*, and the *Clean Air Act* Class I Areas (which require protection of visibility from man-made air pollution).[43]

The following legislation describes pollution standards prescribed for other kinds of development which may be applied to peat. The *Clean Water Act* effluent standards guidelines pertaining to coal mining and processing may be applied to the peat industry. The *Clean Air Act* emission limitations and prevention of significant deterioration air quality permits may also be applied to peat. The *Federal Surface Mining Control Act* may be applied to peat mining and reclamation procedures.[44]

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[43] Institute for Gas Technology, et al, *Feedstock Characteristics and Preparation for Peat Gasification Final Report for Phase II, vol. III* (Chicago: Gas Resource Institute, 1982), pp. 4-12 to 4-15.

[44] *Ibid.*

Minnesota

Minnesota's large, contiguous peatland formations cover 2.4 million hectares and are in many ways similar to those found in the Hudson Bay lowlands of Canada. However, unlike the Hudson Bay lowlands, Minnesota peatlands are relatively accessible and therefore offer significant development opportunities. To date the commercial use of Minnesota's peatlands has been mainly horticultural peat moss production. Several private-sector-Minnesota Department of Natural Resources joint fuel peat operations began in the summer of 1984. Minnesota was the first state to consider fuel peat development when, in 1975, Minnegasco requested to lease 200,000 acres (80,000 ha) of Minnesota peatlands for gasification.

Minnesota Department of Natural Resources (M.D.N.R.)

In 1976, as a result of development pressures, the State Legislature gave the Minnesota Department of Natural Resources a five-year mandate to carry out research for the purpose of producing a peat management policy for state-owned peatlands (50 percent of the total peatland area).

Policy

The Minnesota Department of Natural Resources recommended that peatland development should be encouraged for a variety of uses, thereby ensuring that no one use would achieve a monopoly or near-monopoly of peatland lease holding. The recommended uses include: forestry; wildlife management; preservation; agriculture and bioenergy crop production; horticultural, industrial-chemical, and energy mining. Further, M.D.N.R. recommended that existing management programs (e.g. forestry and wildlife areas) receive precedence over peatland development.

In addition to opinions expressed by the general public, and studies undertaken by M.D.N.R., the following factors have been cited as influencing the evolution of the Minnesota peat policy recommendations:

- apparent changes in emphasis at the federal government level toward the use of alternative energy sources

- private sector interest in leasing state peatlands for energy production
- cooperative efforts of agencies at the state and local government levels to initiate small-scale fuel-peat pilot projects
- the growing conviction that peatlands might be better used for the cultivation of bioenergy crops.

M.D.N.R. has indicated a preference for small-scale peat mining operations similar to the methods used in northern Europe. Large-scale pilot projects, however, are encouraged in order to gain understanding of the associated impacts. M.D.N.R. policy involves the commitment to developing a modest market for fuel-peat. A 200,000 to 300,000 ton demand for fuel-peat is hoped to be created in the next two to three years.

Activities

In 1976, M.D.N.R. established the Peat Program, which focused on the use and development of peatlands greater than 3,000 acres (1,215 ha) in size.

During the 5-year Program, 45 studies were carried out on a variety of topics, including:

- baseline environmental research
- utilization technologies
- public attitudes concerning peatland development and
- socio-economic aspects of peatland management

Prior to these studies, only limited information had been available on the state's peat resource. The Peat Program used the newly-acquired information to develop a peatland inventory, a computerized peatland-use suitability mapping system, and criteria for site-selection. The information was also used to guide policy formulation.

Several advisory groups aided M.D.N.R. in the formulation of their policy recommendations. These included the Interagency Task Force on Peat composed of representatives from M.D.N.R., universities, and the state legislature and the Peat Advisory Committee, composed of citizens, industry, and local government representatives. The Task Force had the lead role in policy formulation. The Advisory Committee provided input from the "user" level. In addition to these external task forces and committees, the M.D.N.R. had its own internal Task Force on Peatlands of Special Interest. This Task Force was established in 1978 with the purpose of identifying candidate peatlands for the following uses:

- preservation of endangered, threatened and rare peatland flora and fauna
- representation of typical peatland types
- preservation of unique geomorphic features
- peatlands of scientific value

On the development side of the issue, the Minerals Division of M.D.N.R. and the Minnesota Energy Agency have been studying the possibility of bioenergy production from peat in the Iron Range region. The Iron Range region is currently dependent on the taconite-ore mining industry and the state would like to see the region broaden its economic base in anticipation of taconite ore depletion by the year 2000.

The Iron Range Resources Rehabilitation Board was created to help reduce unemployment and "economic distress" on the Iron Range in Minnesota. The Board consists of 10 legislators plus the State Commissioner of Natural Resources. The Northwest Minnesota Economic Protection Fund consists of proceeds from the taconite production tax, to be used after the year 2002 to redevelop local economies that will be depressed by the depletion of the taconite ore. Various government officials have suggested that this fund should be made available now to aid the development of the peatlands so that an industry is fully-developed by the time of taconite depletion.

Legislation

In accordance with the Minnesota Statutes, Section 92.50 and subject to the approval of the State Executive Council, the M.D.N.R. may lease state-owned peatlands of a maximum size of 3,000 acres (1,215 ha) to private development for 25 years. This size limit is used as a operating guideline which has, to date, been followed. State-owned peatlands may not be sold. Rents and royalties should be charged for extractive use leases; rents only should be charged for nonextractive uses. Twenty-five years has been recommended as the lease term in order to encourage uses such as agricultural and energy biomass crop growth. Rather than simply reacting to lease applications, M.D.N.R. has proposed a scheme by which peatlands suitable for development would be pre-selected according to a number of criteria, including socio-economic factors, site suitability (area, depth, peat quality), and conservation & preservation conflicts. It is intended that a peatland development "fund" of up to one million acres (approximately 400,000 ha) will be set aside for potential development. Only state-owned peatlands will be included. Developers will be encouraged to select from these reserves. Applications of leases requested on peatlands not included in the reserve would take longer to assess since these sites would have to be reassessed for possible development.

The Pollution Control Agency (PCA) and the Environmental Quality Board (EQB) do not have a peat policy, but they administer legislation that would be applied to peat development. The P.C.A. requires permits for the discharge of pollutants into either the air or the water. The E.Q.B. administers the Minnesota Environmental Policy Act which requires an environmental assessment worksheet for small developments and an environmental impact statement for large developments.

Minnesota is the only state to have legislation which pertains specifically to peatlands. This legislation, which is the amended Minnesota Mineland Reclamation Act (1983), requires reclamation of all areas of peat mining, whether public or private. It also places a limitation on the size of the areas being mined at any one time.

Minnesota also has preservation oriented legislation. Through the Outdoor Recreation Act (Minnesota Statutes 1980, Section 80 A02), the Department of Natural Resources has the responsibility to ensure adequate preservation of Minnesota's peatlands to preserve an accurate representation of Minnesota's fledgling natural and historic heritage for public understanding and enjoyment. The State also has a Peatland Preservation Program[45]. Under this program, 22 acres totalling over 500,000 acres (200,000 ha) have been recommended by a State Task Force for further study regarding their suitability for preservation. Selection of key areas (from the current 22) requiring preservation is now underway. The selection is being carried out by the M.D.N.R. and the Peatland Protection Area Review Committee (PPARC). The PPARC is a temporary, special interest committee, made up of members representing the interests of the private mining and timber industries, local government, environmental groups and universities. The recommendations of the selection process will be available in late 1984.

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[45] Asmussen, D., Minnesota Department of Natural Resources. Personal communication, 21 June, 1984.

Maine

Unlike Minnesota, approximately 95 percent of Maine's lands are privately owned. Competing peatland uses in Maine include commercial timber, agriculture, and recreation. The Maine Critical Areas Program and Land Use Regulatory Commissions selection processes have resulted in a reduction in the number of peatlands available for fuel-peat development. The selection processes have determined that economic peatlands number 80,000 acres (32,000 ha) out of a possible 700,000 acres (280,000 ha) (criteria were a minimum depth of 5 feet and a maximum ash content of 20 percent).

There are currently three commercial agricultural peat mining operations in the state and one fuel-peat production project proposed by Signal Cleanfuel Inc. in 1980.

A request by Signal for a loan guarantee and price support from the Synthetic Fuel Corporation is still under consideration by Congress and the project is not expected to go ahead without these. The project would involve building and operating a facility designed to produce 278,000 tons per year of peat fuel pellets. The project will use the wet carbonization process developed by J.P. Energy OY, Finland and will utilize 1,620 to 2,025 ha of peatland with an average fuel peat depth of 3.0 to 4.5 meters. Forty-one environmental meetings were held from 1980 through 1983 regarding this project. An Environmental Impact Statement process began in 1983 and is still in progress.

State Planning Office

The state energy policy for the long-term was established to "encourage energy conservation and diversification and the use of indigenous and renewable resources so that the state can be more energy self-sufficient." The state energy policy recognizes that peat could play an important role in providing energy in the residential and commercial sectors. Under the policy, environmentally-responsible development of a portion of the state's peat resource is encouraged. The market should allocate peat among competing uses until experience indicates a need for government intervention. Mining peat should be coordinated with development of an articulated reclamation policy consisting of the production of renewable biomass resources or agricultural or silvicultural revegetation. Small renewable uses are favored over gasification.

Activities

The State Planning Office makes recommendations that are carried out by other departments (e.g., determination of non-economic values of peatlands).

The State Planning Office itself undertook a Critical Areas Study of peatlands in cooperation with the Bureau of Public Lands, Department of Conservation. The Critical Areas Program identified the most significant natural features in the state of Maine and included them in a "Register." It was used to recommend peatlands which should be preserved. The program has no legal authority but enjoys considerable public support.

Department of Conservation

In 1981, the state of Maine began an intensive evaluation program to identify its ecologically-significant peatlands. The Department of Conservation Land and Water Resources Council established the Peatlands Preservation Study Sub-Committee, the purpose of which was to identify peatlands that shoud be preserved for their value as habitats for rare plant or animal species or for other significant characteristics.

The sub-committee identified criteria for evaluating individual peat deposits. However, they recommended that a new committee, composed of individuals with expertise in various aspects of peat, be formed to determine which of Maine's economically-significant peat deposits should be protected.

The Department of Conservation used the general peatland preservation criteria recommended by the Peatland Preservation Study Sub-committee to develop the Maine Peat Resource Matrix, in consultation with more than thirty different government agencies, universities, conservation and naturalist groups, industry and associations. The Matrix is composed of a number of categories, including:

- peat deposit name and location
- estimated short tons of commercial quality peat
- acreage of commercial quality peat
- rare peatland type
- outstanding example of peatland type
- rare species present
- significant cultural value
- quality of information
- comments

New categories can be added as more information becomes available on such aspects as diversity of ecological communities and component species; importance as wildlife habitats; and hydrological and geochemical characteristics. The Matrix data are used to aid in identifying areas which should be preserved from that group of peatlands also considered to be economically significant. The Matrix is not used to rank the peatlands.

The Maine Office of Energy Resources

The Maine Office of Energy Resources (MOER) follows the state policy respecting peat. MOER has no regulatory power but offers advice and information on energy related issues.

Activities

The Peat Program inventory was conducted by the Maine Office of Energy Resources (MOER) and the Maine Geological Survey and in 1979 and 1980 received $250,000 from the U.S. Department of Energy (DOE) for this purpose. MOER has also established a Peat Steering Committee, composed of representatives of the state, private sector, environmental groups, and interested parties, to give MOER advice on peat-related issues.

Land Use Regulatory Commission (LURC)

The Land Use Regulatory Commission (LURC) has direct jurisdiction over all of Maine's unorganized townships and plantations, which contain many of the commercially-exploitable peatlands in the State. To mine peat on lands under LURC's jurisdiction, it is necessary to obtain a permit from LURC as well as from the Department of Environmental Protection.

The LURC has stated its policy on peat mining in its Comprehensive Land Use Plan for the entire state:

> "Peat moss is a commercially valuable product which may be harvested from some wetlands ... Removal of the full depth of peat by strip mining can have serious adverse impact on water level, water quality and wildlife ... However, peat mining under controlled conditions that allow for regeneration can occur with minimal disruption.
>
> All bogs within the LURC's jurisdiction are included in the LURC's Wetland Protection Subdistrict (P-WL), with one exception.
>
> The purpose of the P-WL Protection Subdistrict is to conserve wetlands in essentially their natural state because of the indispensible biologic, hydrologic and environmental functions which they perform.
>
> Mineral extraction, including peat mining or harvesting, is not one of the uses allowed in the P-WL Protection Subdistrict. However, it is possible to petition the LURC for a change in the boundary of any land use district. This change must be consistent with the standards for district boundaries in effect at the time, the Comprehensive Land Use Plan, the intent of the LURC statute; and there must be substantial evidence that changed conditions have made the present classification unreasonable. Mineral extraction is allowed by permit from the LURC in the Commercial and Industrial Development Subdistrict (D-CI)."[46]

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[46] J. Davis "Perspectives on Peat Development and Utilization in Maine" in Symposium Papers Peat as an Energy Alternative II (Arlington: Institute of Gas Technology, 1981), pp. 771-783.

The LURC also classified the more economically-significant peatlands according to their value for purposes other than peat harvesting.

The Department of Agriculture, Food and Rural Resources

The Department of Agriculture, Food and Rural Resources has taken the position that, because peat is currently useful for small-scale soil amelioration it should be considered for similar uses on a large-scale.

An Agricultural Peat Task Force was established in 1980 to determine the types of uses for peatlands and compare them with the value of agricultural uses. The Task Force determined that much research demonstration is necessary before farmers can wisely invest large sums of money in peat for soil amelioration. However, the Task Force felt it was conceivable that the amount of peat used in agriculture could be on the same order of magnitude as that used for energy production. The Task Force concluded that the necessary research in the agricultural utility of peat be accelerated so the potential value of the resource can be assessed on the basis of comparable information.

Legislation

Peat is defined as a mineral under the Mining and Rehabilitation Land Law. It is an energy resource and its extraction constitutes mining. The law requires a mining and reclamation plan for the removal of more than 1,000 yd^3 of product from the earth within 12 consecutive months. A bond not less than \$100 nor more than \$1,500 per acre is also required to be forfeited if rehabilitation is not carried out. Maine's Mineral Policy was revised in 1980 to include a severance tax on the extraction of certain non-renewable minerals in Maine, including peat.

The No Adverse Environmental Effect Standard of the Site Location of Development Law, administered by the Department of the Environment, applies to all development undertaken in Maine and constitutes the toughest legislation affecting peat development in the U.S. The Law involves a public hearing process and the imposition of conditions on development projects. The Law directly refers to bogs when it addresses the preservation of unusual natural areas.

Other land-use acts administered by the Department of the Environment include the Coastal Zone Management Act, Protection of Improvement of Water Law and the Great Ponds Act, all of which require permits for the use of land or water under their jurisdiction.

Alaska

Alaska has the largest peat fuel resource in the United States and is the only state which is considering the economic viability of peat as an export commodity. The geography of the resource and economics of fuel transportation in Alaska are expected to lead to the evolution of a combination of large centralized and small local developments. Large scale development of Alaska's peat resources is expected to occur along the railway corridor (Anchorage, Fairbanks, Kenai Penninsula, and the Valdez - Glenallen areas) because of the existing infrastructure of services.

State of Alaska Department of Commerce and Economic Development, Division of Energy and Power Development

The Division undertakes all peat-related activity in Alaska. The Division views peatland utilization as a potentially important contributor to the state's economy. Both small and large scale peat projects are to be encouraged.

Alaska Peat Development Programs

- A Survey Program of potential fuel peat areas was undertaken by United States Geological Survey, Nortec, Alaska Geological Survey

  Future work will be concentrated on expanding programs to other areas

- Rural Alaska Peat Farm involves harvesting peat and air drying it indoors. The program is attempting to develop peat as a direct heat source for home consumption in bush communities. Bristol Bay Native Association has stated that peat is a surface mineral and has given local support and coordination.

- South Central Alaska Commercialization Program for Peat - the state of Alaska Division of Energy and Power Development - intends to negotiate a contract for the purpose of encouraging and assisting private enterprise to initiate commercial peat operations in South Central Alaska. The principal objective of the project will be a final evaluation report, but the projects started will be encouraged to continue.[47]

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[47] D. Markle, "Alaska Peat Resource Development" in Symposium Papers - Peat as an Energy Alternative II (Arlington: Institute of Gas Technology, 1981), pp. 737-771.

Florida

The entire state falls under purview of the Coastal Management Zone Act, and this designation precludes any development of industry without a great deal of state and federal regulations. The state also requires a Development of Regional Impact Review which emphasizes environmental impacts.[48]

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[48] Institute of Gas Technology, et al. p. 4-21.

North Carolina

Many of the peatlands of North Carolina fall under the Coastal Zone Management Act and therefore development is prohibited.

However, an ambitious peat development project is occurring under the sponsorship of a private corporation, First Colony Farms. They intend to utilize 407 million tons of peat to supply energy to the state. After the peat has been harvested, First Colony Farms plans a reclamation program to develop the areas into fertile farmland. By 1981, the corporation had spent over $1 million on peat development which included development of customized harvesting techniques based on Finnish technology. Dewatering technology is not being developed, however, because the peat is air-dried in wind rows. First Colony Farms has commissioned Southern Engineering Co. to construct a 130 MW peat-fuel powerplant. Long-range plans include construction of a 600 MW powerplant which would use peat sods.[49]

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[49] R.N. Campbell, "First Colony Farms, Inc., Experimental Peat Harvesting Program" in Executive Conference Proceedings Management Assessment of Peat as an Energy Resource (Arlington: Institute of Gas Technology, 1979), pp. 93-97.

APPENDIX 1

FEDERAL/PROVINCIAL JURISDICTIONAL RESPONSIBILITIES IN RESOURCE MANAGEMENT

Juridictional Responsibility in Resource Development

Peat development is subject to constitutional limits which define the responsibilities of both the federal and provincial governments in the realm of resource development and management.

The legislative authority of the federal and provincial governments over resources, which would include peat, is governed by the provisions of the Constitution Act, 1867 and certain amendments to this Act, specifically the Constitution Act, 1981. Under these constitutional provisions, the provincial governments are granted broad powers to enact laws dealing with the management, development and conservation of renewable and non-renewable resources as well as research concerning these resources. The federal government's powers are more limited, specifically to regulate interprovincial and international trade and commerce in resources, to tax resource-based income, to regulate the agricultural use of resources, and to enact laws governing the management, development and conservation of resources on Indian reserves, in national parks, and in the Northwest and Yukon Territories.

The most important source of provincial legislative jurisdiction is section 92 (13) of the Constitution Act, 1867, which provides that provincial legislatures may exclusively make laws in relation to the property and civil rights in the province. The recent amendments to section 92 (the Constitution Act, 1981, section 92A) confirm certain powers of the provincial legislatures and enlarge the constitutional power of the provinces to make laws with respect to the export from the province to other provinces of primary production from non-renewable natural resources and forestry resources and to tax those resources by any mode of taxation.

> 92A. (1) In each province, the legislature may exclusively make laws in relation to
>
> (a) exploration for non-renewable natural resources in the province;
> (b) development, conservation and management of non-renewable natural resources and forestry resources in the province, including laws in relation to the rate of primary production therefrom;...
>
> (2) In each province, the legislature may make laws in relation to the export from the province to another part of Canada of the primary production from non-renewable natural resources and forestry resources ... in the province ... but such laws may not authorize or provide for discrimination in prices or in supplies exported to another part of Canada.
>
> (3) Nothing in subsection (2) derogates from the authority of Parliament to enact laws in relation to the matters referred to in that subsection and, where such a law of Parliament and a law of a province conflict, the law of Parliament prevails to the extent of the conflict.
>
> (4) In each province, the legislature may make laws in relation to the raising of money by any mode or system of taxation in respect of
>
> (a) non-renewable natural resources and forestry resources in the province and the primary production therefrom ...
>
> whether or not such production is exported in whole or in part from the province, but such laws may not authorize or provide for taxation that differentiates between production exported to another part of Canada and production not exported from the province.

Under subsection 92A(1), provinces have exclusive power to make laws governing the exploration, development, conservation and management of non-renewable natural resources. Presumably these law-making powers also include processing, refining and marketing of the resource within the province. Provincial legislative powers under subsections 92A(2) and (4) are not exclusive. Parliament also may enact laws over interprovincial trade in production from non-renewable natural resources and forestry resources and over the direct or indirect taxation of those resources. Where a provincial and a federal law conflict, the federal law is paramount.

Section 92A concerns non-renewable natural resources, and forestry resources, implicitly distinguishing these from other renewable resources. Provincial legislative powers governing renewable resources aside from forestry resources are not affected by section 92A; provincial legislative authority over renewable non-forestry natural resources presumably does not include the expanded taxation and extraterritorial powers of section 92A.

However, peatlands are not used solely for extractive purposes, apart from forestry, which is also subject to section 92A, other in-situ uses such as agriculture, managed wildlife habitats, recreational purposes or conservation could bring into question the validity of categorically classifying peat as a non-renewable resource. The discrepancy will stem from whether it is the peat material or the peatland which is considered to be the resource for any given purpose.

A second source of provincial legislative jurisdiction is section 95 of the Constitution Act, 1867. This provides that both Parliament and the provincial legislatures may enact laws governing agriculture, but that federal laws take precedence in cases of conflict. Given that, where in use, peat resources are at present used almost exclusively for agricultural purposes, provincial laws governing the management, conservation and research and development of peat resources that are supplementary to bone fide agricultural laws and that are not in conflict with similar federal laws are probably constitutionally valid.

Federal legislative jurisdiction over peat resources derives primarily from the Constitution Act, 1867 s. 91(2)(The Regulation of Trade and Commerce); s. 95 (Agriculture), and s. 91(3)(the raising of Money by any Mode or System of Taxation). The scope of section 91(2) has been judicially restricted to international or interprovincial trade and commerce, excluding intraprovincial trade and commerce. This section provides jurisdiction to make laws governing the national or international marketing, sale and distribution of resource products which would include peat.

As indicated above, the federal government also has legislative jurisdiction, concurrent with the provinces, over agriculture. Federal statutes whose aim is the improvement of agriculture or agricultural practices that regulate the management, development and conservation of agricultural peat are probably valid.

The federal taxation power (s. 91(3) of the Constitution Act, 1867) allows Parliament considerable scope to encourage (or discourage) research into, or the management, development or conservation of peat resources. As under the present Petroleum Incentives Program, the government could erect a program with suitable incentives (tax credits and deductions, grants) or disincentives (taxes) to achieve federal goals with respect to peat resources. This type of legislative power can be extremely effective in encouraging research, exploration or development, but might operate at cross-purposes to valid provincial enactments governing peat resource research and development.

Although provincial legislatures have authority to enact laws regulating research, exploration, development and conservation of natural resources such as peat, the federal government can exert considerable influence through its ability to allocate public funds to peat projects in exchange for a measure of control over such projects. Such has been the case with the federal-provincial Conservation and Renewable Energy Demonstration Agreements, from which funding has been allocated toward three fuel-peat demonstration projects in two provinces. This financial power is not, of course, a source of legislative jurisdiction; in practical terms, however, it is often just as effective or expedient.

The issue of whether peat is a non-renewable natural resource, determines the extent of provincial jurisdiction described in section 92A of the Constitution Act 1981. It is certainly true that peat bogs are capable of regenerating over time, through the increase in accumulated remains of the sphagnum mosses and associated plants in the bog community. However, it also might be argued that coal, oil and natural gas resources also regenerate over time albeit a very long time. On the other hand, forest resources, which are clearly renewable natural resources, may take between 40 and 100 years to regenerate.

The issue as to whether or not peat resources are non-renewable or renewable natural resources for the purposes of this legislation probably turns on the scientific evidence of the time required for regenerating a peat bog. Available evidence suggests that peat regenerates at a rate in the order of ten to thirty millimetres every 100 years -- that is, extremely slowly. Such slow rates of regeneration make peat resources more akin to coal, oil and natural gas than to forestry resources. In addition, provincial regulatory schemes tend to treat peat as a non-renewable as opposed to a renewable resource. It is likely, then, that for the purpose of extractive uses, the courts would regard peat as a non-renewable resource subject to the provisions of section 92A.

APPENDIX 2

SUMMARY OF CANADIAN LEGISLATION PERTAINING TO PEAT

Federal

Peat disposition is only a matter of federal jurisdiction in the Territories where there is currently little interest in peat development. Consequently, the bulk of federal legislation related to peat consists of general environmental protection or conservation-oriented legislation under which peat could be included. However, some general resource development oriented legislation has been applied to peat.

The federal Agricultural and Rural Development Agreement Act encourages the rehabilitation of land (including peatlands) for agricultural use. The Act provides the opportunity for the provinces to enter into a funding agreement with the federal government for this purpose.

Environment Canada administers a number of acts, some of which could be used to preserve peatlands and some of which could be used to regulate peatland development and its effects.

The Fisheries Act applies to all internal waters, waters in fishing zones and the territorial sea. Section 33 of the Fisheries Act states that "no person shall undertake work which results in the alteration, disruption or destruction of fish habitat." Permits are required for the addition of deleterious substances to fish habitat. This would suggest that the draining of peatlands prior to harvesting would be affected by this Act.

The Ocean Dumping Control Act prohibits the deposition of waste materials within tidal lands which includes some peatlands.

The Canada Water Act provides the opportunity for the federal government to enter into an agreement with a provincial government to ensure the optimum use of water. Any federal water may be designated as a water quality management area and pollution regulations prescribed for the area. Research into wetlands may be undertaken as part of the development of plans for the management of water resources and thus provides a mechanism through which the federal government may participate in certain aspects of resource development and management, including peatlands.

The Department of the Environment Act provides the authority for the Environmental Assessment and Review Process. This process could require an environmental impact assessment for any peat development project in which the Crown was the proponent.

Under the Canada Wildlife Act, "where the Governor in Council is satisfied that any public lands are required for wildlife research, conservation, or interpretation, he may assign the administration, management and control of such lands to the Minister of Environment Canada." The Minister of Environment Canada may enter into an agreement with a provincial government for any of the above purposes. The Canadian Wildlife Service's National Wildlife Areas and Bird Sanctuaries have been established under this Act and could potentially include peatlands.

National Parks have included peatlands in the past and the National Parks Act provides protection of these areas from development.

Provincial

In Canada a limited amount of legislation applies to peat. The main part of this legislation sets out the terms of peat disposition. Some of the legislation promotes the rehabilitation and development of peatlands for agricultural uses. The remainder of the legislation specifies environmental protection standards or conservation mechanisms that might be applicable to peatlands. In the last three categories, however, there is more legislation which could be applied to peat than currently is applied to peat.

New Brunswick, Newfoundland, Ontario, Quebec, Manitoba and Alberta have disposition legislation for both fuel and horticultural peat. British Columbia and Saskatchewan have legislation which is used for horticultural peat disposition even though it does not specifically refer to peat. The Nova Scotia Department of Lands and Forests has jurisdiction over peat and is developing a peat disposition policy for the province. Prince Edward Island does not have any legislation which refers to peat but acknowledges that the Excavation Pits Regulations of the Mining Act would apply to peat. The Territories have no peat disposition legislation as the Federal government has jurisdiction over this land.

Peat is considered by all provinces to be a surficial material and is subject to quarrying regulations. Only Quebec has included peat under resource extraction taxation legislation.

British Columbia, Manitoba, New Brunswick have used legislation which has allowed them to enter into a funding agreement with the Federal government to rehabilitate peatlands for agricultural use.

While all the provinces have created statutes which allow them to establish environmental conservation areas such as parks, reserves, research areas, etc., only Saskatchewan, New Brunswick, Ontario and Alberta have used these mechanisms to include peatlands in several of these provincial areas.

Newfoundland has applied environmental legislation to peatland operations. Each province, however, has acts which govern the physical manipulation of watercourses as well as their biological and chemical disturbance. Each province also has a more general environmental act which could be used to enforce limits for peat-related pollutants once such limits are established.

A summary of the provincial legislation which affects peat is provided in Table A. Table B presents the provincial legislation which could potentially be applied to peat. Table C summarizes the federal legislation pertaining to peat.

TABLE A: FEDERAL LEGISLATION WHICH AFFECTS PEAT

Federal	Disposition	Development Oriented	Environmental Standards	Conservation Oriented
	Territorial Lands Act R.S. 1970	Agricultural and Rural Development Agreement Act R.S. 1970, C. A-4	Fisheries Act R.S. 1970, C. F-14	Canada Wildlife Act 1973, C. 21
			Ocean Dumping Control Act 1976, C. 55	National Parks Act R.S. 1970, A-13

TABLE B: PROVINCIAL LEGISLATION WHICH AFFECTS PEAT

Province	Disposition	Development Oriented	Environmental Standards	Conservation Oriented
Newfoundland	Quarry Materials Act R.S.N. 1976, No. 45		Environmental Assessment Act R.S.N. 1980, c.3	
Prince Edward Island	Planning Act R.S.P.E.I. 1974, c. P-6, Excavation Pits Regulations			
Nova Scotia	Mining Act R.S.N.S. 1979 L-6			Department of Lands and Forests Act R.S.N.S. 1979, L-6
New Brunswick	Quarriable Substances Act R.S.N.B. 1973, Q-1			National Park Act R.S.N.B. 1973, N-1
Quebec	Mining Law R.S.Q. 1977, C. M-13, Mineral Taxation Act 1977 C. I-3			
Ontario	Mining Act R.S.O. 1980, C. 268, Public Lands Act R.S.O. 1980, C. 413			Conservation Authorities Act R.S.O. 1980, C. 85
Manitoba	Department of Agriculture Act, 1982, A-40	Mines Act C. M-160, Quarrying Minerals Regulations 226/76		
Saskatchewan	Mines Act Department of Agriculture Act			Provincial Parks and Protected Areas Act 1978 P-34
Alberta	Public Lands Act - Surface Minerals Regulations 11/78			Wilderness Areas, Ecological Reserves, and Natural Areas Act, 1984, W-8
British Columbia	Land Act R.S.B.C., 1979, C. 214	Agricultural and Rural Development Act R.S.B.C. 1979, C. 7, Agricultural Land Commission R.S.B.C. 1979, C. 9		

TABLE C: PROVINCIAL LEGISLATION WHICH COULD BE APPLIED TO PEAT

Province	Disposition	Development Oriented	Environmental Standards	Conservation Oriented
Newfoundland			Water Protection Act R.S.N. 1970, No. 394	The Wilderness and Ecological Reserve Act S.N. 1980, C. 2
Prince Edward Island			Environmental Protection Act R.S.P.E.I. 1974, E-8.1	
Nova Scotia		Marshland Reclamation Act R.S.N.S. 1979, M-8	Environmental Protection Act R.S.N.S., 1979 E-14, Water Act R.S.N.S. 1979, W-3	Special Places Protection Act R.S.N.S. 1979, S-48
New Brunswick		Marshland Reclamation Act R.S.N.B. 1973, M-5	Clean Environment Act R.S.N.B. 1973 C-6, Water Act R.S.N.B. 1973, W-5	Ecological Reserves Act S.N.B. 1975, E-1.1
Quebec			Water Courses Act R.S.Q. 1977 R-13, Environmental Quality Act R.S.Q. 1977, Q-2	An Act to Preserve Agricultural Land R.S.Q. 1977 D-41, Ecological Reserves Act R.S.Q. 1977, R-26
Ontario			Environmental Protection Act R.S.O. 1980, C. 141, Environmental Assessment Act R.S.O. 1980, C. 140 Water Resource Act	Endangered Species Act R.S.O. 1980 C. 138, Wilderness Areas Act R.S.O. 1980, C. 533
Manitoba			Clean Environment Act 1970, C-130, Water Rights Act 1970 W-80	Wildlife Act 1970, W-140
Saskatchewan				
Alberta			Clean Air Act 1984, C-12, Clean Water Act 1984, C-13, Water Resources Act 1984, W-5	
British Columbia		Agricultural Land Development Act R.S.B.C. 1979, C. 10	Environment and Land Use Act R.S.B.C. 1979, C. 110, Environment Management Act S.B.C. 1981, C. 14, Pollution Control Act S.B.C. 1982, C. 41 Water Act R.S.B.C. 1979, C. 428	Wildlife Act 1982, S.B.C C.57, Soil Conservation Act

APPENDIX 3

CROWN PEAT RESOURCE MANAGEMENT POLICY FOR NEW BRUNSWICK

Objectives of the Policy

The policy is intended to achieve the following objectives:[1]

a) ensure that the resource makes a maximum contribution to the long-term economic development objectives of the Province;

b) simplicity of administration of tenure and collection of revenue;

c) peat production from freehold as well as Crown land;

d) operation in a manner which will not jeopardize future utilization or rehabilitation.

Policy

1. Eligibility to Lease Peatland

Before an application for a peat lease will be considered, the applicant must provide assurance that the amount and quality of peat in the proposed lease area is known and that the peat would be developed and harvested according to an acceptable plan. Accordingly, the applicant for a lease is required to obtain and fulfill the conditions of a peatland exploration licence. Such a licence will:

a) be renewable annually for a maximum of three years providing the applicant submits evidence of $1.25/hectare ($0.50 /acre) expenditure for the first year and $2.50/hectare ($1.00/acre) for the second and third year or on payment in lieu of this expenditure; and

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[1] Mineral Resource Division, Crown Peat Resource Management Policy (Fredericton: New Brunswick Department of Natural Resources, 1979)

b) authorize the holder to evaluate that peatland within one designated area of not more than 800 hectares (approximately 2,000 acres).

Applications will be considered only if accompanied by:

i) an application fee of $100;

ii) an outline of the exploration proposed;

iii) sufficient data on the applicant's financial capability and marketing plan to permit the Department of Commerce and Development to make an assessment of the possible impact on any existing N.B. producers, and, advise D.N.R. on the ability of the applicant to finance the proposed exploration and development. The peatland exploration licence will be granted only if:

a) the applicant has no other peatland exploration licence or has relinquished any exploration licence in effect;

b) the harvesting from the proposed area would not jeopardize the future availability of peat for an existing lease-holder, either adjacent to or in the area;

c) the Department of Commerce and Development advises D.N.R. of the capability to finance the envisaged development and market the product without jeopardizing the existing N.B. industry.

All exploration survey data obtained under the licence or by the licencee will be submitted to the Department of Natural Resources on surrender of the licence. This data will be kept in public files unless it is submitted by a licencee who is subsequently granted a lease, in which case the data will be kept confidential for five years from the date of issuance of the lease.

2) Peat Production Lease

a) Qualification:

In order to qualify for a production lease the exploration licencee must have fulfilled the requirements under the peatland exploration licence in a manner acceptable to the Department. The data obtained under the licence will form the basis of the supporting documentation of a lease application which must contain the following and be accompanied by an application fee of $25.00 and a security deposit (see (d) below):

i) a survey of the boundary of the proposed lease area by a registered N.B. land surveyor;

ii) profiles of the peat bog surveyed for location and elevation and providing peat type, depth, bottom soil conditions, as required by the exploration licence;

iii) a drainage plan;

iv) a harvesting plan;

v) a plan of anticipated future expansion, and

vi) a plan for abandonment of the bog on cessation of production.

b) Term:

The term of leases will be for ten years with provision for renewal in 10-year periods providing there had been continuous production at a minimum rate of 10,000 bales or bale equilvalents per year during the final three years of the lease period and at least a total of five years of production at the same minimum rate during the term of the lease, and, other conditions of the lease have been met.

c) Size of Leases:

Leases are not to exceed 250 hectares (618 acres) unless warranted on the basis of bog configuration, drainage and resource utilization considerations. In any case, the Department of Natural Resources will provide, if so required by the lessee, a negotiable, time-limited (maximum ten years from issuance of lease) first option on a buffer area, the actual size and shape of which will depend on bog configuration, drainage characteristics and management needs. This will ensure the producer of a long term supply and the opportunity of expansion. It will be subject to review and possible cancellation on failure to comply with the approved development plan. The annual option fee will be half the area rental rate for a lease.

d) Security Deposit - Performance Bond:

In order to ensure compliance with production and abandonment plans, lease applications will be considered only if accompanied by a security deposit of $2,000.00 payable to the Minister of Finance and in any of the following forms:

i) cash;

ii) negotiable bearer bonds of the Government of Canada or the Province of Canada or the Province of New Brunswick;

iii) term savings certificates or term deposits issued by a Canadian chartered bank and assigned as to principal to the Minister of Finance;

iv) certified cheque.

A reclamation surcharge on royalty will be payable at the rate of 1/2¢/bale equivalent until an additional $3,000 (or a total of $5,000) is accumulated per 250 hectares of leased area. The lessee will have the option of paying the entire deposit in advance of obtaining the lease.

On abandonment of leases in a satisfactory state the deposit will be returned exclusive of interest.

e) Rental Fees for Leased Area

The annual rental fee for leased peatland will be $1.00 per acre or $2.50 per hectare.

f) Existing Leases

Existing leases or leases issued before October 1, 1977 will on expiry be renewed in their existing configuration for 10-year periods subject to compliance with the requirement for submitting acceptable drainage, harvesting and abandonment plans. The security deposit and land rental fee will be required on renewal of existing leases or beginning in 1980, whichever is earlier.

3) Royalty

The royalty under the new policy is based on quantity of production in order to ensure that it does not become a charge on efficiency and to maximize simplicity of administration. The rate will be increased over a period of years to minimize the impact on producers and to maintain the competitive poisition of N.B. costs to the market. In 1980 the rate will be 2¢/bale equivalent* produced. There will be an increase of 1¢/bale in each subsequent year until the rate reaches 5¢/bale in the fourth year.

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* Bale Equivalent: For this purpose is based on the present six cubic foot bale where the raw peat at approximately 50% moisture content is compressed 2:1.

APPENDIX 4

GUIDELINES FOR WETLAND MANAGEMENT IN ONTARIO

Purpose

These Guidelines represent the Province of Ontario's concern for wetlands and wetlands management. The purpose is to ensure that wetlands are managed in keeping with both present and long-term needs of the people of Ontario.

Interpretation

These guidelines do not supersede or take priority over other provincial planning policies, and recognize that other matters, such as housing, forestry, agriculture, mining, watershed protection, tourism, recreation, environment, and the concerns of native people, must also receive consideration in land-use planning. Wetland management should be implemented in conjunction with relevant provincial policies and regulations.

Definition

For the purpose of these guidelines, wetlands are areas with shallow standing water, (less than 2 meters deep), until about July 1, in most years. They are divided into 4 major categories: swamps, marshes, bogs and fens.

Background

Wetlands are important to Ontario's economy. They maintain and improve water quality, help control flooding, provide habitat for fish and wildlife, and contribute substantial social and economic benefits. These include outdoor recreation and tourism benefits from such activities as hunting, fishing and bird-watching amounting to over 53 million user-days per year for 7 million residents. Wetlands also contribute to the ecological diversity of the landscape and provide habitat for several threatened and endangered species. They provide protection against flooding by holding rainfall during peak periods and releasing it over the following months. They are a source of many important resource products, such as fur, wood, and wild rice, valued in excess of 300 million dollars annually. The benefits they provide and the overall provincial interest in wetlands should be taken into account in any related planning action.

The Provincial Evaluation System

Individual wetlands will be identified and classified according to a standardized methodology contained in:

> An Evaluation System for Wetlands of Ontario South of the Precambrian Shield. Second edition. Ontario Ministry of Natural Resources and the Canadian Wildlife Service. Toronto: OMNR, CWS, 1984.

Principles

The following principles form the basis of these Guidelines.

1. Wetlands are essential natural resources. When properly classified according to their function, wetlands can be managed for the maximum benefit of all residents of Ontario.

2. All land use planning and resource management agencies should recognize wetlands as important components of their comprehensive plans and programs, and have a responsibility to ensure their plans and actions consider all the benefits of wetlands when arriving at decisions.

3. All parts of Ontario possessing wetlands share a responsibility for their wise management.

4. The protection of wetlands should not interfere unreasonably with existing uses of private land either within the wetland or in surrounding areas.

Application

The following guidelines apply to those wetlands identified and classified according to the provincial evaluation system as being of provincial significance (generally, Classes 1 and 2) and those additional wetland areas identified by municipalities as being significant and incorporated within their planning documents.

1. General Guideline

1.1 Every land-use planning and resource management agency should have regard for the implications of its actions on wetlands within its management area.

1.2 All municipalities should ensure that official plans, by-laws and planning programs undertaken by their respective Council or by delegated authority have regard to these planning guidelines.

2. Official Plans

2.1 Wetlands identified as having significance should be protected from incompatible activities wherever possible.

2.2 Developments in wetlands can occur under carefully considered circumstances where it can be shown that the wetland values can be managed adequately.

3. Zoning By-Laws

3.1 Lands identified in an official plan for protection as wetlands should be placed in a zoning category that only permits uses that are compatible with wetland management, such as forestry, aquaculture, fisheries management, wild rice, waterfowl production, and open space.

3.2 In municipalities not subject to an official plan, significant wetlands should be identified for protection on advice of the Ministry of Natural Resources and placed in a zoning category which prohibits uses that are incompatible with future existence of the wetland.

4. Implementation

The objective of the Government is to ensure optimum economic and social benefits are obtained from the land with minimal disturbance to remaining wetlands.

This can be achieved through implementation of these guidelines, including the following government functions.

4.1 The Government will:

a) provide on a priority basis all pertinent information, including mapping and technical assistance, to any government body or planning authority, in particular municipalities, and assist them to define and protect wetland areas; priority will be given to inventorying areas undergoing official plan preparation and review.

b) provide comments to planning review and approval agencies on proposed technical planning actions that may have implications for wetland development. Comments shall relate to the compliance of these actions with these guidelines and to wise resource management;

c) prepare technical documents to assist municipalities and other agencies responsible for wetland planning and management, in implementing this Guideline.

d) undertake research programs to investigate a wide array of wetland management topics. Special emphasis shall be given to managing wetlands for as wide an array of benefits to the people of Ontario as possible.

e) review and comment upon application of the evaluation system carried out by or on behalf of municipalities.

APPENDIX 5

AN EVALUATION SYSTEM FOR WETLANDS IN ONTARIO

Wetlands are land types that are commonly referred to as swamps, fens, mires, marshes, bogs, sloughs and peatlands. They occur intermittently across the landscape of southern Ontario along lakes, rivers, streams and in headwater areas. They vary in size from a fraction of a hectare to many thousands of hectares. They may be relatively simple or highly complex and diverse.

A system of evaluating wetlands was created for the purpose of measuring wetlands values.[1] Its application is calculated to reveal not only which wetlands in an area, a region, or in southern Ontario as a whole are more valuable but also why one wetland is more valuable than another. It is intended to be used as a tool or instrument at various levels in Ontario's Planning Process. The ultimate aim is to be able to rate wetlands with regard to their relative value so that people who make decisions about land-use will have a means through which to ascertain which wetlands are the more valuable.

The need or "justification" for the development of this system of evaluation for Ontario's wetlands from several considerations. The greatest need stems from the fact that virtually no prior work had been done to quantify wetland values in a manner which permits comparison of wetlands in order to make knowledgeable land use decisions. Another consideration derives from an increased scientific understanding of the role that many wetlands play in maintaining wildlife populations, regulating stream flow and in pollution abatement. Wetlands are truly unique areas where land and water come together, providing habitat for a diverse variety of wildlife species that can live nowhere else. Many people see wetlands as having special and unique recreational, educational and scientific value to themselves and to society as a whole. Yet until now no mechanism has existed to identify which wetlands in a given area or region are the most important to society as a whole. The system of evaluation should meet this need.

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[1] Ontario Ministry of Natural Resources and the Canadian Wildlife Service, An Evaluation System for Wetlands of Ontario South of the Precambrian Shield, second edition (Toronto: OMNR, 1984).

Since the evaluation system was designed to identify and measure some of the most important values of wetlands in an unbiased manner, it should provide an accurate mechanism or framework through which conflicting claims about wetland values and uses can be resolved. By applying this system, knowledge of the different kinds of wetland values would become available for examination and assessment by an interested person, agency or group. Judgements about the best possible use of any wetland could then be made on the basis of relatively objective information. If insufficient information about the values of a particular wetland still existed, more could be obtained by individuals or groups. Decisions about future uses of a wetland can thus have a more rational basis.

The evaluation system can be applied to all Ontario wetlands south of the Canadian Shield. It should also be applicable to those wetlands in a band extending roughly between Haliburton and Leeds counties where significant calcareous drift overtops the Shield.

Implementation of the Evaluation System may take place at three levels.

(a) by a municipality, regional government or county as part of the Municipal Planning Process where often there is need for a mechanism to obtain some objective insights or knowledge into the value of a particular wetland in relation to other nearby wetlands;

(b) by Conservation Authorities as part of an overall watershed management plan, or by MNR Districts in relation to the need to develop wildlife and other resource management objectives or because of a need to contribute professional advice about wetlands during the development of Municipal Plans and review of drainage proposals; and

(c) by the province as an aid to broad planning. In this regard a wetlands evaluation system will serve as an essential cornerstone of a wetlands policy where there is need for an objective mechanism to identify the most valuable wetlands in the province. As well, the evaluation system will prove of value in identifying provincially or nationally important wetland habitat for migratory birds.

This evaluation system will therefore have both a short and a long term practical application and use to the people of Ontario.

The provincial evaluation system is used to evaluate wetlands and rank them into 7 classes. The classification is based on the following point scores:

Class 1 - 700 or more total points or 3 out of 4 components which score higher than 200 points each;

Class 2 - 650 or more total points or 2 out of 4 components which score higher than 200 points each;

Class 3 - 600 or more total points or 1 out of 4 components which score higher than 200 points;

Class 4 - 550 or more total points or all out 4 components scores above 100 points each;

Class 5 - 500 or more total points or 3 out of 4 components which score more than 100 points each;

Class 6 - 450 or more total points or 2 out of 4 components which score more than 100 points each;

Class 7 - all others not included above.

APPENDIX 6

COORDINATING ORGANIZATIONS FOR CANADIAN PEAT ACTIVITIES

There are numerous organizations - federal, provincial and international - which are used as vehicles for organizing and coordinating peat activities in Canada. These organizations, comprised of committees, sub-committees, working groups and associations have varying degrees of responsibility and effectiveness in advising on or directing peat research and development in the country. Some have a distinct advisory role, others exist for the purpose of promoting communication of ideas amongst and between the various government levels and the private sector.

Although most of these organizations have only recently been established (several are in their first year), at least one will soon be approaching its 40th anniversary and others have been established for over a decade.

Following is a brief description of nine organizations which have been established specifically for the purpose of coordinating peat or peat-related activities - federally, provincially, and internationally.

1. Peat Forum - is a committee comprised of technical experts from several federal governments with an interest in peat. Peat Forum acts as a technical advisory committee to the Peat Program in matters concerning the evaluation of proposals for contracts awarded through the program. The committee which was established in 1981 is chaired by NRC and has members from the Departments of Environment; Energy, Mines and Resources; Agriculture; Indian Affairs and Northern Development.

2. Peat Environmental Committee - chaired by the Environment Protection Service, Environment Canada, this committee meets annually to discuss current and proposed projects of relevance to environment concerns regarding peatland development. The committee has a variable membership but invites participation from other EC agencies and federal government departments, provincial government agencies, the private sector and universities.

3. Peatland Subcommittee of the NRC Associate Committee on Geotechnical Research - undoubtedly the oldest committee in Canada concerned with peat, this group was established in 1947 as the Muskeg Subcommittee. The committee has sponsored 18 conferences devoted to muskeg research. Its role has been to identify problem areas concerning the geotechnical aspects of peatland utilization and to advise the Associate Committee on research needs in this field as well as promoting research. The committee is comprised of members drawn largely from the engineering community in federal government agencies, universities and private industry.

4. The National Wetlands Working Group -chaired by the Land Resource Research Institute, Agriculture Canada, the working group was established in 1975 as a sub-committee of the Canadian Committee on Ecological Land Classification. The working group includes members from federal and provincial agencies, universities and private industry. Each province has its own working group or chapter with a provincial chairperson. The aim of the working group is to provide coordination and expertise on various aspects of resource and ecological assessment pertaining to all wetland types.

5. Peat Technical Working Group - Interprovincial Advisory Committee on Energy - the Working Group was established in 1981 with the intent of achieving the following objectives:

   - strengthen communication with and between the government and the private sector
   - identify and advise the NRC and other groups of projects eligible for funding
   - encourage the development of demonstration projects
   - ensure adequate exposure and future funding in peat-related areas

It has had questionable success in all of the above and although membership is extended to all provinces, only those in Eastern Canada have been particularly active. Because of the current waning interest on the part of the provinces in the fuel peat energy sector, the future of the working group is not certain. Meetings have been convened at Canadian peat symposia.

6. Interministerial Committee on Peat (Ontario) - was established in March 1984 and is comprised of permanent members from three Ontario ministries: Natural Resources, Energy, and Northern Affairs. The Committee is chaired by the Ontario Ministry of Natural Resources and in addition has a full-time secretary/administrator. The committee will be constituted for an initial three year period which may be extended if the need for a permanent peat committee becomes apparent. The Committee will be primarily concerned with identifying directions for peat development in Ontario, directing available funds from participating ministries to development projects, encouraging a greater interest in peat resource development in the province and providing a government focal point for the public with regard to peat and peat-related matters.

7. Newfoundland-Labrador Peat Association - is the only provincial peat association in Canada. It was formed in 1977 following a symposium on the peatlands of Newfoundland-Labrador, sponsored by the Memorial University of Newfoundland. Once associated with the Canadian National Committee-International Peat Society, the Association is now an autonomous group. The Association was formed with the intent to raise public awareness of the resource potential of peat in the province. The association meets on a quarterly basis and meetings are a balance between themes of general interest to the public and those of a technical nature. The Association has its own publication - Peat News - which is published quarterly. The Association is strictly regionally-oriented and participates in considerable interaction between the federal and provincial governments, industry and university members. The Association intends to acquire a lease for a local bog which would be used by the Association for small research projects, for testing equipment and as a supply of horticultural and fuel peat to participatory members.

8. Canadian National Committee - International Peat Society - is one of 14 national committees whch comprise the international peat community. The CNC-IPS membership is drawn from the Canadian peat community in general. Members receive all NRC-Peat Program-sponsored publications and other relevant information from the IPS. CNC-IPS has organized jointly with other sponsoring agencies four Canadian peat symposia. The CNC-IPS provides a liaison between the Canadian and International peat communities. The committee does not hold general meetings and the Executive meet formally at Canadian Symposium. There are no provincal or regional chapters. The Committee is involved in organizing and promoting research-related activities.

9. The International Energy Agency - Canada is an active member of a newly-formed sub-committee to enhance international exchange of information concerning the research and development of peat for energy. The sub-committee, established in February, 1984, is composed of four member countries: Sweden, Finland, Ireland, and Canada. This group will concern itself with five research areas, including:

- improvement of milled and sod peat production - Finland, Ireland and Sweden will participate in investigations; Ireland and Finland will be responsible for the presentation of results

- new technology in peat dewatering - Canada, Finland and Sweden will participate; Sweden will be responsible for the presentation of results

- basic research in peat dewatering - Canada, Sweden and (to a lesser extent) Finland will participate; Canada will be responsible for reporting

- peat classification and standardization - all four countries will participate; Sweden will be responsible for reporting

- information exchange - Ireland (Bord na Mona) will be responsible for this activity

The first stage will be to present a state-of-the-art report on these five research areas and to make recommendations on international cooperation in these areas. The work should be presented by mid-1985.

APPENDIX 7

Persons and Agencies Contacted in the Project Study

Eastern Canada

Newfoundland

Name	Affiliation	Location
Mr. T. Cahill	Department of Rural Agriculture and Northern Development Government of Newfoundland and Labrador	Mt. Pearl
Mr. Cashin	Department of Regional Industrial Expansion	St. John's
Mr. E. Dawe	Northland Associates	St. John's
Dr. P. Morin Mr. J. Waterhouse Mr. W. Smith	Faculty of Engineering & Applied Science, Memorial University	St. John's
Mr. D. Rees	Noval Technologies/Hi-Point Peat	St. John's
Mr. A. F. Rayment	Agriculture Canada Research Centre	St. John's
Mr. D. Vanderveer	Department of Mines and Energy Government of Newfoundland and Labrador	St. John's
Mr. E. D. Wells	Newfoundland Forest Research Centre Environment Canada	St. John's
Mr. L. White	Newfoundland and Labrador Peat Assoc.	St. John's
Mr. A. Winsor	Energy Policy Division Department of Mines & Energy	St. John's

Nova Scotia

Name	Affiliation	Location
Mr. A. Anderson	Department of Mines and Energy	Halifax
Ms. S. Day	Environmental Protection Service, Environment Canada	Halifax
Mr. H. Hirvonen	Lands Directorate, Environment Canada	Dartmouth
Mr. D. Kelly	Environmental Protection Service, Environment Canada	Dartmouth
Mr. T. Perrot	Nova Scotia Land Survey Institute	Lawrencetown
Mr. J. Sheppard	Atlantic Research Laboratories, National Research Council	Halifax

New Brunswick

Mr. J.Y. Daigle	Centre Universitaire de Shippegan	Shippegan
Mr. D. Gemmel Mr. R. Shaw	Mineral Development Branch, Department of Natural Resources	Fredericton
Mr. G. Hache	Acadian Peat Moss	Lameque
Mr. R. Landine	A.D.I. Ltd.	Fredericton
Mr. P. Monti	Environmental Services Branch Department of the Environment	Fredericton
Mr. G. O'Brien	Department of Commerce and Development	Fredericton
Mr. R. Sisk	Community Improvement Corporation	Fredericton
Mr. J. Williamson	Energy Secretariat	Fredericton

Prince Edward Island

Name	Affiliation	Location
Mr. W. MacQuarrie Mr. J. De Grace	Energy & Minerals, Department of Energy and Forestry	Charlottetown
Dr. J. Te Raa	Energy Secretariat	Charlottetown

Central Canada

Quebec

Mr. Barbelescu Mr. R. Boulet	Centre de Recherche Industrielle du Quebec	Ste. Foy
Dr. M. Beerlie Dr. B. Cayrol Dr. E. Chornet	Department of Chemical Engineering Sherbrooke University	Sherbrooke
Mr. R. Carbonneau	Ministère de l'Energie et des Ressources	Ste. Foy
Mr. J.Y. Chateauvert		
Dr. H. Grangberg	Department of Geography, McGill University	Montréal
Mr. E. Kukkonen	Technopeat	Dorion

Ontario

Name	Affiliation	Location
Mr. S. Benzirma	Ontario Energy Corporation	Toronto
Mr. W. Blakeman	Environmental Protection Service Environment Canada	Ottawa/Hull
Mr. A. Boissoneau	Ontario Centre for Remote Sensing	Toronto
Ms. K. Clarke-Whistler	IEC Beak Consultants	Mississauga
Mr. D. Dobbs	Canada Forestry Service Environment Canada	Ottawa
Mr. D. Gillespie	Canada Wildlife Service Environment Canada	Ottawa
Mr. G. Hunter	Gary Hunter and Associates	Mississauga
Mr. R. Laughlin Mr. M. Mckim	Ontario Research Foundation	Mississauga
Dr. M. Levesque Dr. S. Mathur Mr. C. Tarnocai	Land Resource Research Institute Agriculture Canada	Ottawa
Mr. G. W. Mankinen	Montreal Engineering Company	Toronto
Mr. C. Rubec	Lands Directorate Environment Canada	Ottawa
Mr. E. W. Stobart	Ontario Ministry of Energy	Toronto
Dr. P. Telford	Ontario Geological Survey Ontario Ministry of Natural Resources	Toronto

Name	Affiliation	Location
Mr. J-Y. Tremblay	Resource Supply and Information Branch, Energy, Mines and Resources	Ottawa
Mr. H. Von Cube	Ministry of Northern Affairs	Toronto
Mr. J. Waller	Federal-Provincial Demonstration Program, Energy, Mines and Resources	Ottawa
Mr. B. Ward	Ministry of the Environment	Toronto

Western Canada

Manitoba

Name	Affiliation	Location
Mr. B. Bannatyne	Geological Services Branch Department of Energy & Mines	Winnipeg
Mr. V. Bowerman	Energy Division Department of Energy & Mines	Winnipeg
Mr. P. Brockington	Industry Branch Industry, Trade & Technology	Winnipeg
Mr. S. Loman	Department of Economic Development and Tourism	Winnipeg
Dr. J. Stewart	Department of Botany, University of Manitoba	Winnipeg

Saskatchewan

Name	Affiliation	Location
Mr. P. Guliov	Industrial Minerals Division Department of Natural Resources	Regina
Dr. A. Szladow	Saskatchewan Power Corporation	Regina

Alberta

Name	Affiliation	Location
Mr. L. Bailey	Agricultural Processing Development Branch, Alberta Agriculture	Edmonton
Mr. L. Bykowski	Langley Peat North Ltd.	Selba Beach
Mr. H. Johansen	Golden West Seeds Ltd.	Calgary
Mr. H. Martens	Hardy Associates Ltd.	Calgary
Mr. C. Schuring	Land Management Division Department of Energy and Natural Resources	Edmonton
Mr. R. Shelford	Land Classification Section Department of Energy and Natural Resources	Edmonton
Dr. L. Turchenek	Soils Department, Alberta Research Council	Edmonton
Dr. D. Vitt	Department of Botany, University of Alberta	Edmonton
Mr. S. Zoltai	Northern Forest Research Centre Environment Canada	Edmonton

British Columbia

Mr. J. Bell	Langley Peat North Ltd.	Vancouver
Dr. Driehuyzen Mr. R. Kilpatrick	Ministry of Agriculture and Food	Abbotsford

Name	Affiliation	Location
Mr. C. Regier	Peat Co. Technology Inc.	Chilliwack
Mr. D. Stephen	Fisons Western Corporation	Vancouver
Europe		
Scotland		
Mr. N. Godsman	Northern Peat and Moss Company	Cairngall Aberdeenshire
Dr. G. Pyatt	Norther Research Station Forestry Commission	Roslin
Mr. R. Robertson	MaCauly Institute for Soil Research Department of Peatland and Forest Soils	Aberdeen
Mrs. N. Tompter	Scottish Peat and Land Development Association	Edinburgh
Ireland		
Mr. A. Cole	Peatland Experimental Station	County Kildare
Mr. S. Grogan Mr. D. O'Brien	Bord na Mona	Dublin
Mr. P. McDonnell	An Foras Taluntais	Dublin
Mr. J. Ryan	Forest and Wildlife Service	Co. Bray

England

Name	Affiliation	Location
Mr. D. Dickens	Fisons Corporation	Ipswich
Mr. Evans	Minerals Section, Somerset City Council	Somerset
Mr. R. Lindsay	CST Peatlands Nature Conservancy Council	London
Miss J. Smart	Ecology Section, Greater London Council	London
Mr. Troon	Land Use and Conservation, Ministry of Agriculture, Food and Fisheries	London
Miss A. Ward	Department of the Environment	London

Finland

Prof. L. Heikurainen	Department of Peatland Forestry University of Helsinki	Helsinki
Mr. V. Koskinen	Association of Finnish Peat Industries	Helsinki
Dr. J. Paivanen	Department of Peatland Forestry Forest Research Institute	Vantaa
Mr. K. Sipila	Technical Research Centre of Finland	Espoo
Dr. D. Asplund	Technical Research Centre of Finland	Jyvaskyla

Sweden

Name	Affiliation	Location
Mr. K. Hedén	Svenska Torvfoeraedling AB	Stockholm
Ms. M. Ljunggren	Energy Division, Ministry of Industry	Stockholm
Mr. R. Petterson	Svenska Torv Skaane AB	Soesdala

The Netherlands

Dr. de Bakker Ing. B. ten Cate	Institute for Land and Water Management, Soil Classification Section	Wageningen

Germany

Mr. J. Guenther	Torfforschung GmbH	BadZwischenahn
Dr. H. Kuntze	Niedersaechsisches Landesamt fuer Bodenforschung, Bodentechnologisches Institut Bremen	Bremen
Dr. H. Schneekloth	Niedersaichsisches Landesamt fuer Bodenforschung	Hannover
Dr. M. Schuch Mr. M. Meindl	Bayersiche Landesanstalt fuer Bodenkultur and Pflazenbau	Muenchen

United States

Dr. D. Asmussen	Minnesota Department of Natural Resources	St. Paul

Telephone or Letter Contacts

Eastern Canada

Nova Scotia

Name	Affiliation	Location
Dr. A. Hanson	Institute for Resource and Environmental Studies Dalhousie University	Halifax
Mr. E. MacAuley	Forestry Branch, Department of Lands and Forests	Halifax
Mr. Dale Smith	Environment Newfoundland & Labrador Parks Planning Branch Departments of Lands and Forests	Belmont

New Brunswick

Name	Affiliation	Location
Mr. F. Rogers	Roger Bros. Ltd.	St. John

Central Canada

Quebec

Name	Affiliation	Location
Georges B.B. LE	Ministère de l'Energie et des Ressources	Québec

Ontario

Name	Affiliation	Location
Mr. G. Briskel	Canadian Wildlife Federation	Ottawa

Name	Affiliation	Location
Ms. K. Cole	The Nature Conservancy of Canada	Toronto
Ms. M. La Croix	Unesco, Man and Biosphere Program	Ottawa
Mr. J. C. Lauzier	Natural Resources Branch Canadian International Development Agency	Ottawa
Ms. J. Lillycrop	Information Analyst, NSERC	Ottawa
Mr. D. Lohnes Mr. D. Yurich	Parks Canada, Environment Canada	Ottawa
Mr. J. Mathews	OMNR, Mining, Lands Section	Toronto
Mr. D. Needs	Canadian Wildlife Service Environment Canada	Ottawa
Dr. Oosterveld	Lakehead University Centre for Regional Development	Thunder Bay
R. Rogers	OMNR, Lands Supervisor, Carleton Place District	Carleton Place
Mr. G. Sheehy	Canadian Nature Federation	Ottawa
Mr. J. Stocking	Interministerial Committee on Peat OMNR	Toronto
Mr. L. Tremblay	Demonstration Section, Renewable Energy Division, Energy, Mines and Resources	Ottawa
Dr. P. Stokes, P.A. Moore	Institute for Environmental Studies University of Toronto	Toronto

Western Canada

Manitoba

Name	Affiliation	Location
Mr. A. Borys	Land Branch, Department of Natural Resources	Winnipeg
Mr. P. Caldwell	Ducks Unlimited Canada	Winnipeg
Mr. J. Partridge	Land Utilization and Soil Survey Section, Agricultural Development and Marketing Division	Winnipeg

Saskatchewan

Name	Affiliation	Location
Mr. A. Appleby	Department of Parks and Renewable Resources	Regina
Mr. H. T. Epp	Environmental Assessment Branch Saskatchewan Environment	Regina

Alberta

Name	Affiliation	Location
Mr. G. Irwin	Vehicle Mobility Section, Defence Research Establishment	Suffield/Ralston
Dr. D. J. Pluth	Department of Soil Science University of Alberta	Edmonton
R. D. McDonald	Scientific & Engineering Services and Research Division	Edmonton

Name	Affiliation	Location
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